BIOMASS FUEL
UTILIZATION STUDY

in Northern Newfoundland and Coastal Labrador

BIOMASS FUEL UTILIZATION STUDY

IN NORTHERN NEWFOUNDLAND AND COASTAL LABRADOR

Prepared for:

Newfoundland and Labrador Rural Development Council

Prepared by:

Highlands Contracting Ltd.
Acres Consulting Services Ltd.

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EXECUTIVE SUMMARY

This study involved the review of the potential to convert commercial buildings to wood burning in three areas of coastal Labrador and Newfoundland as follows:

Region 1-Labrador Coast
Region 2-Labrador Straits
Region 3-Roddickton/Main Brook

A visit was made to each area to investigate the buildings conversion potential and the available wood resource of each area. A number of criteria were chosen and weighed by importance. Each building was scored and the region totals determined the best region. Region 1 was chosen as having the most potential. The main factors were cheaper wood and higher fuel prices.

The wood conversion was studied from the point of view of using wood chips and roundwood. It was determined that the economy of scale was not large enough to justify wood chipping and a heat storage solid wood burning unit was recommended.

An economic analysis of the payback periods revealed that paybacks of 5 to 11 years were realizable. Pay back periods are longer in Mary's Harbour and St. Lewis because of higher wood costs.

The three buildings offering the best conversion potential at this level of study are the Grenfell Hospital in Charlottetown, the Charlottetown Inn and the Grenfell Hospital in Port Hope Simpson. The Pentecostal School in Port Hope Simpson also shows a relatively short payback period, but the installation is probably too large for a demonstration project.

It is recommended that the three most likely buildings be investigated in more detail to determine final sizing and wood fuel requirements. The interest of the administration must be confirmed. When firm prices for wood fuel and for equipment, building additions and installation are obtained a final decision can be made.

The study also looked at the potential to ship firewood from Port Hope Simpson to communities on the coast of Labrador. The costs were found to be favourable and a trial was recommended for 1985.

ÉTUDE SUR L'UTILISATION DE LA BIOMASSE DANS LE NORD DE TERRE-NEUVE ET SUR LA CÔTE DU LABRADOR

Résumé

Dans l'étude, les possibilités de convertir au bois les systèmes de chauffage des immeubles commerciaux ont été évaluées dans trois régions côtières du Labrador et de Terre-Neuve: la région 1, soit la côte du Labrador qui englobe les agglomérations de Charlottetown, de Port Hope Simpson, de St. Lewis et de Mary's Harbour; la région 2, soit le détroit du Labrador, qui englobe celles de Red Bay, de West St. Modest, de L'Anse-au-Loup, de l'Anse-au-Clair et de Forteau; et la région 3, soit celle de Roddickton/Main Brook, qui englobe celles de Roddickton, de Main Brook, de Conche, de Bide Arm et de Englee.

Les responsables de l'étude se sont rendus dans chacune de ces régions pour évaluer les possibilités de conversion des immeubles et les ressources en bois disponibles. Un certain nombre de critères ont été choisis et évalués selon leur importance et un pointage a été attribué à chaque immeuble. Le total des points a servi à déterminer la région la plus prometteuse, en l'occurrence la région 1; les principaux motifs du choix étaient la faiblesse du prix du bois et les coûts plus élevés des combustibles.

La conversion au bois a été étudiée en fonction de l'utilisation de copeaux de bois et de bois rond. On a conclu que les économies d'échelle n'étaient pas assez importantes pour justifier l'utilisation des copeaux de bois et on a recommandé celle d'appareils alimentés au bois rond pouvant emmagasiner la chaleur. Une analyse économique a révélé que les coûts pourraient être amortis dans une période de cinq à onze ans. Toutefois, la période d'amortissement est plus longue dans le cas de Mary's Harbour et de St. Lewis en raison du coût plus élevé du bois.

À ce stade-ci de l'étude, les trois immeubles offrant les meilleures possibilités de conversion sont l'hôpital Grenfell de Charlottetown, le Charlottetown Inn et l'hôpital Grenfell de Port Hope Simpson. L'école pentecôtiste de Port Hope Simpson pourrait être aussi retenue, les coûts pouvant être amortis sur une période assez courte, mais l'installation est probablement trop vaste pour un projet de démonstration.

On recommande que les trois immeubles susceptibles d'être retenus soient évalués en détail afin de déterminer les dimensions exactes et l'approvisionnement nécessaire en bois. De plus, l'administration devra confirmer sa participation dans ce projet. Une décision finale pourra être prise lorsqu'on aura déterminé les coûts définitifs de l'approvisionnement en bois, de l'équipement, des ajouts aux immeubles et des installations.

Dans l'étude, on a également envisagé la possibilité d'expédier du bois de chauffage de Port Hope Simpson aux agglomérations situées sur la côte du Labrador. Cette mesure a été jugée rentable et des essais sont recommandés pour 1985.

L'étude a été réalisée pour le compte du Newfoundland and Labrador Rural Development Council par la Highlands Contracting Ltd. et la Acres Consulting Ltd. grâce aux contributions versées par le Programme de démonstration dans les collectivités éloignées d'Énergie, Mines et Ressources Canada et le ministère des Mines et de l'Énergie de Terre-Neuve et du Labrador.

1.0 INTRODUCTION:

This report deals with a Biomass Study-Northern Newfoundland and Coastal Labrador. The study is a pre-feasibility study concerning the use of wood as an oil replacement alternative in remote communities along the southern coast of Labrador and the top portion of the Northern Peninsula of Newfoundland. The work, carried out under the guidance of the Newfoundland and Labrador Rural Development Council, was funded from the Remote Community Demonstration Program of Energy, Mines and Resources Canada and the Department of Mines and Energy.

The study area is broken down into three regions with selected communities reviewed in each region. They are as follows:

Region 1-Labrador Coast

1. Charlottetown
2. Port Hope Simpson
3. St. Lewis
4. Mary's Harbour

Region 2-Labrador Straits

1. Red Bay
2. West St. Modest

3. L'Anse au Loup
4. L'Anse au Clair
5. Forteau

Region 3-Roddickton/Main Brook

1. Main Brook
2. Roddickton
3. Conche
4. Bide Arm
5. Englee

The study examined the potential of burning both woodchips and roundwood in the commercial and institutional sectors. Also, the feasibility of establishing a regional and community delivery system for the wood products was considered.

In carrying out the study, the consultants involved first reviewed any available information on the area. Then questionnaires were prepared and the areas were visited . Each potential conversion building was visited and informed managers were interviewed. The information collected was analyzed by computer to provide the necessary planning information required in the terms of reference for the study.

A standard heating system was selected.

2.0 SOCIAL AND ECONOMIC PROFILE:

The following is a profile on the regions included in this study. The information for the most part came from the "Remote Community Demonstration Program-Newfoundland Region Overview Study". The map in Figure 1A shows the study areas.

Region 1-Coastal Labrador from Mary's Harbour to Charlottetown

The communities represented in this region are as follows:

1. Charlottetown
2. Port Hope Simpson
3. St. Lewis
4. Mary's Harbour

As a whole the region has fishing, trapping, and forestry as an economic base. The forestry sector is confined to Port Hope Simpson where one sawmill operates.

The present energy needs are supplied by oil, electricity, and wood. Oil heats the commercial buildings, supplements most domestic needs and runs a diesel electric generating station in all of the communities.

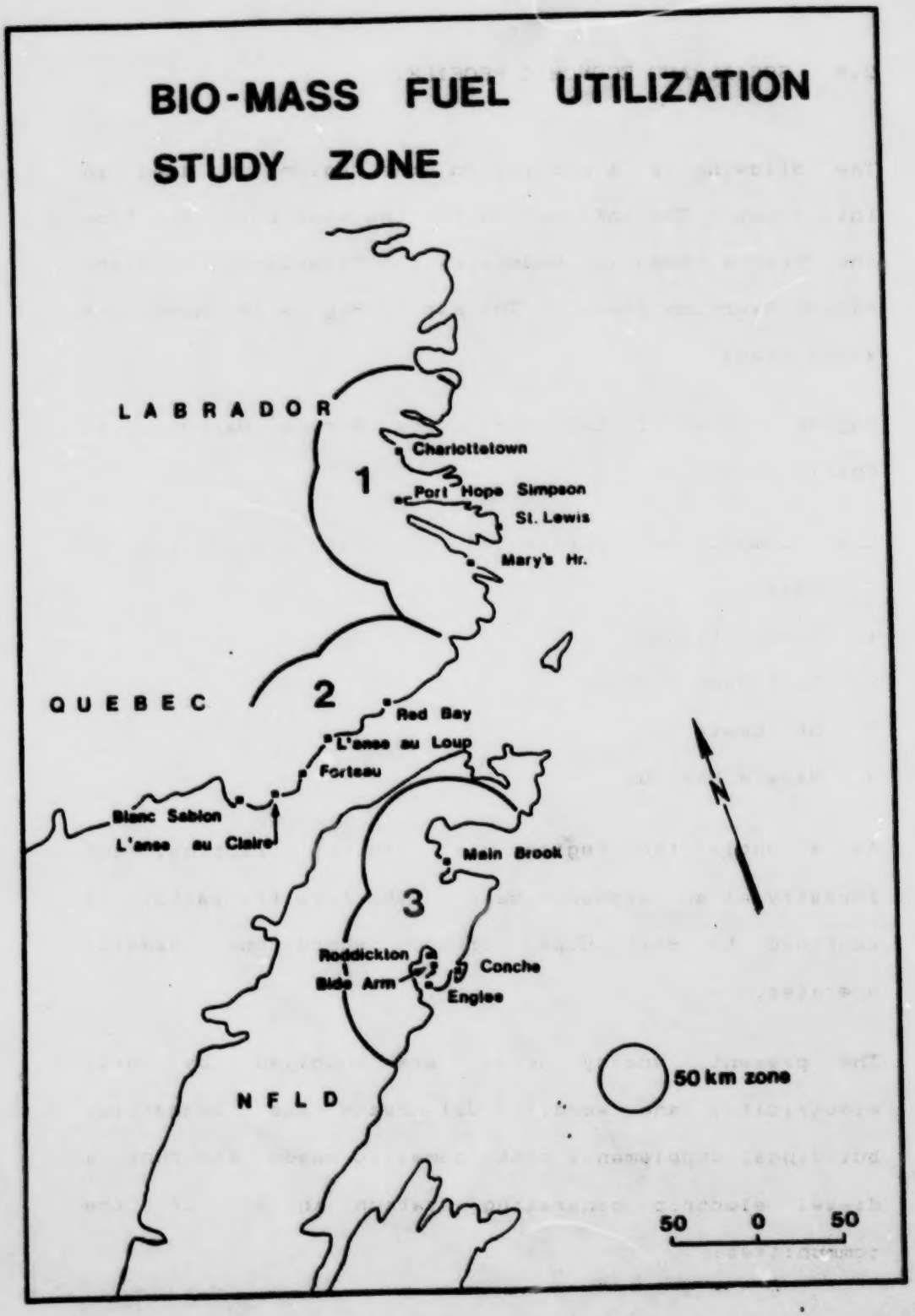

BIO-MASS FUEL UTILIZATION
STUDY ZONE
LABRADOR
QUEBEC
NFLD
1
2
3
Charlottetown
Port Hope Simpson
St. Lewis
Mary's Hr.
Red Bay
L'anse au Loup
Forteau
Blanc Sablon
L'anse au Claire
Main Brook
Roddickton
Bide Arm
Conche
Englee
N
50 km zone
50 0 50

Figure 1 A

The logging operations in the area would have to be carried out by ski-doo and horse in the case of Port Hope Simpson. However, winter operations on a small commercial scale are not profitable. The heavy snow falls (440 cm.) which tend to stay on the ground would seriously hinder a commercial logging operation. The only practical method of logging in the winter is with ski-doo. It would seem reasonable at this point that fuelwood logging be completed in the summer and the wood stored in covered accessible sheds for the winter.

Region 2-Coastal Labrador from L'Anse au Clair to Red Bay

The communities covered in this region are as follows:

1. Red Bay
2. West St. Modest
3. L'Anse au Loup
4. L'Anse au Clair
5. Forteau

The economic base of these communities is fishing.

The energy needs have traditionally been supplied by oil and electricity. Oil heats the commercial buildings, runs a diesel electric station at L'Anse au Loup (suppling the whole region) and is a supplement to domestic householders. Domestic heating was almost all

accomplished by oil until the recent rate increases, and now the majority of the people burn wood.

The wood resource in the area is very limited. The only major source of wood is the Pinware River watershed. This area is only accessed by 2 km of road. However, the Department of Forestry, Resources and Lands plans to build more road. In any case, considering the heavy demand for wood in the local areas this access would not last long. At this point, it is considered a must to ferry truck loads of wood from the Island to provide a long term reliable supply of wood for the commercial sector.

As far as harvesting wood is concerned, winter cutting is almost out of the question with average snowfalls of 468 cm. This combined with cold temperatures would make road clearing for a small operation very expensive. No doubt ski-doo operators could supply some of the wood needs but a stock pile from summer operations would be a must to ensure a supply. Starting a woods operation is a possibility in the Pinware River area, but for the present trucked in wood from the Island would be necessary and not that expensive.

Region 3-Roddickton-Main Brook Region

The communities considered in this Region are as follows:

1. Main Brook
2. Roddickton
3. Conche
4. Bide Arm
5. Englee

The economic base for this region is forestry and fishing.

The energy needs are served by diesel electric generating stations at Roddickton and Main Brook. Oil heats most commercial buildings and is a supplement for domestic home heating.

This region has an abundant supply of fuelwood which is readily accessible and can be bought at a reasonable price. Winter logging is not a problem but large snowfalls would prohibit outside storage of wood.

A summary of the regions is presented in Table 1, Community Profile. This Table concentrates on the communities present energy demands.

TABLE 1

COMMUNITY PROFILE

Ca	Community	Pop	House Holds	Elec kwh	Fur oil liters	Stove oil liters	Wood cds
R1	Port Hope Simps	581	110	695,352	nil	54,553	990
R1	Charlottetown	250	49	373,123	nil	158,284	450
R1	Mary's Harbour	400	85	823,231	nil	136,383	760
R1	St. Lewis	280	55	619,165	nil	168,825	490
R2	West St. Modest	273	50	697,950	nil	234,578	450
R2	Red Bay	316	85	723,806	nil	229,123	760
R2	L'Anse Clair	267	65	647,569	nil	198,936	580
R2	L' Anse au Loup	589	130	1,580,284	nil	600,884	1,170
R2	Forteau	520	130	1,225,695	nil	489,148	1,170
R3	Main Brook	514	125	950,689	272,689	40,915	1,120
R3	Roddickton	1,142	260	2,619,894	495,523	22,730	2,340
R3	Conche	464	110	667,585	363,667	36,369	990
R3	Bide Arm	339	60	733,806	68,191	22,730	540
R3	Englee	998	235	2,458,542	354,595	27,277	2,110

3.0 FORESTRY

3.1 Region Profile

A planning forestry profile is presented for each community in Table 2. The information has been summarized from a questionnaire carried out to 2-5 informed people in each community. The questionnaires on which the data was collected are included in Appendix 4.

In Table 2, the rating system is as follows:

E excellent

G good

F fair

P poor

Y yes

N no

TABLE 2

BIOMASS WOOD INVENTORY

Category	PLACE	BS %	BF%	WB%	Ht./Ft	Age Yr	Avail/50km	Res.
Region 1	Charlottetown	90	10	0	25	100+	E	N
Region 1	Mary's Harbou	90	10	0	25	100+	P	N
Region 1	Port Hope Sim	90	10	0	40	100+	E	Y
Region 1	St. Lewis	90	10	0	25	100+	P	N
Region 2	Red Bay	10	90	0	20	100+	F	N
Region 2	West St. Mode	10	90	0	20	100+	F	N
Region 2	L'Anse au Lou	10	90	0	20	100+	F	N
Region 2	L'Anse au Cla	10	90	0	20	100+	F	N
Region 2	Forteau	10	90	0	20	100+	F	N
Region 3	Main Brook	20	80	0	45	70+	E	Y
Region 3	RoddicKton	20	70	10	45	70+	E	Y
Region 3	Conche	20	70	10	45	70+	F	N
Region 3	Bide Arm	20	80	0	45	70+	G	N
Region 3	Englee	20	80	0	45	70+	G	N

BS% Black Spruce percent

BF% Balsam Fir percent

WB% White Birch percent

Ht.Ft. Average height of the trees in the area

Age Yr. Average age of the forest in years

Avail/50km Availability of wood in the area

Res. Sawmill residue availability

The information in Table 2 provides general information but, nevertheless, an accurate picture of the forestry activities in the communities studied.

In reviewing Table 2 by Region, the following summaries result:

Region 1 - The forest of this region is mainly Black Spruce over 100 years old. The average tree height is relatively short ranging up to 40 feet. In Port Hope Simpson and Charlottetown, there is an abundance of wood within 50 km but at St. Lewis and Mary's Harbour wood is in short supply. Sawmill residue is available only at Port Hope Simpson but is not used for any heating purposes. In the communities, 90%(taken from the questionnaires completed) of the households burn wood and the domestic total wood consumption is approximately 2,690 cords.

Region 2 - The forest of this Region is mainly Balsam Fir over 100 years old. The average tree height is very short ranging up to 20 feet. In all communities wood is in short supply within 50 km. Sawmill residue is not available. In the communities, 90%of the households burn wood and the domestic total wood consumption is 4,130 cords.

Region 3 - The forest of this Region is mainly Balsam Fir with some Black Spruce and White Birch over 70 years

old. The average tree height is relatively short ranging up to 45 feet. In all communities wood is in good supply within 50 km. Sawmill residue is available only at Main Brook and Roddickton but is not used for any heating purposes. In the communities, 90% of the households burn wood and the domestic total wood consumption is 7,090 cords.

These summaries provide an overview of the Regions but more detailed information was required to make long term decisions of wood availability for burning. Ground cruise information on Regions 1 & 2 (Dept. of Forest, Resources and Lands) and existing information on Region 3 (Dept of Forest, Resources and Lands and Northlands Associates) were reviewed in compiling inventory statistics. Also, a limited aerial inspection was done. A summary table, map and description is presented on each Region as follows.

Region 1

This area, commonly referred to as the southeast coast of Labrador, is the area from Hawkes Bay to Battle Harbour in the south. For study purposes this area is broken into 12 watersheds (See map, Figure 1). This area is a portion of Forest Management Unit 19 and is administered by the Forest Management Unit Office at Otter Creek, Goose Bay, Labrador.

Within the area, there are 166,900 ha. of merchantable timber with a total volume of 15,112,000 cubic meters. This total inventory figure must be reduced by 52% which is the factor applied to the global inventory from which the information was derived. The adjusted figure is 7,254,000 cubic meters. As well, there are large tracts of burnt timber in the area. A breakdown is shown in Table 3.

TABLE 3

REGION 1 INVENTORY

WATERSHED	HA.	VOL.M3
St. Paul's River	nil	nil
St. Charles River	100	4,000
St. Lewis Inlet	27,200	2,082,000
Alexis River	51,100	4,029,000
Gilbert River	13,900	1,243,000
Paradise River	26,400	2,505,000
Pinsent Arm	800	71,000
White Bear Arm	14,700	1,402,000
Snug Harbour	1,800	157,000
Hawke Bay	27,100	3,020,000
Black Bear River	1,800	599,000
Total	166,900	15,112,000

INVENTORY OF FOREST RESOURCES
REGION 1
Total Volume m³ 7,254,000
Area in ha. 166,900
Avg. m³ per. ha. 43
Total Burnt area (ha.) 2,015,000
STUDY AREA
Hawke Bay
Charlottetown
RIVER
Port Hope Simpson
RIVER
Lewis Bay
ST LEWIS
N
0 10 20
km.
FORESTED
BURNT
SAWMILL
RESOURCE ROAD

FIG. 1

Fire is a dominating factor when studying the Forest Resource of this area of Labrador. Much of the area was burnt over during the bad fires of the mid 1960's and smaller tracts of land were burnt over during the mid 1970's. Today most of the burnt timber still stands. The bark and soot have washed off over time and only the dry, grey sticks remain. This would be an excellent source of domestic fuelwood.

The merchantable timber is found predominately in the Port Hope Simpson, Alexis River, St. Lewis River and Paradise River areas. The rest is scattered in pockets throughout the area.

There is only one sawmill presently operating in the area. It is situated at Port Hope Simpson. The only resouce road in the area is located to the west of Port Hope Simpson. This road was constructed by Bowaters Nfld. Ltd. to facilitate resource extraction when they harvested in the area as part of their Export Wood Operations in the mid 1960's.

Much of the timber in this area is inaccessible at present. There is no developed road network to assist in extraction. Very little harvesting has occurred, with the exception of the Bowater Export Wood operation.

Region 2

This area is part of Forest Management Unit 19 and is administered by the Forest Management Unit Office of the Department of Forest, Resources and Lands situated at Otter Creek, Goose Bay, Labrador.

The Pinware River Watershed contains the only commercial timber resources on the southern coast of Labrador (Figure 2). These commercial timber stands are located along the banks of the Pinware River and its tributaries. Timber rights to the extra area are maintained by the Crown and cutting is regulated through the issuance of cutting permits.

The valley sides of the Pinware River are very steep and this is where the majority of the resource is located. There is only 2 km of resource road into the area to facilitate ease of extraction. Presently the timber is harvested mostly when the river is frozen. Ski-doos are then used to transport the timber to roadside. One problem encountered is that the river does not freeze up every year and when it does the length of freeze up is unpredictable.

The area has been so heavily harvested for domestic use in the past that forestry officials have been forced to restrict harvesting in this area.

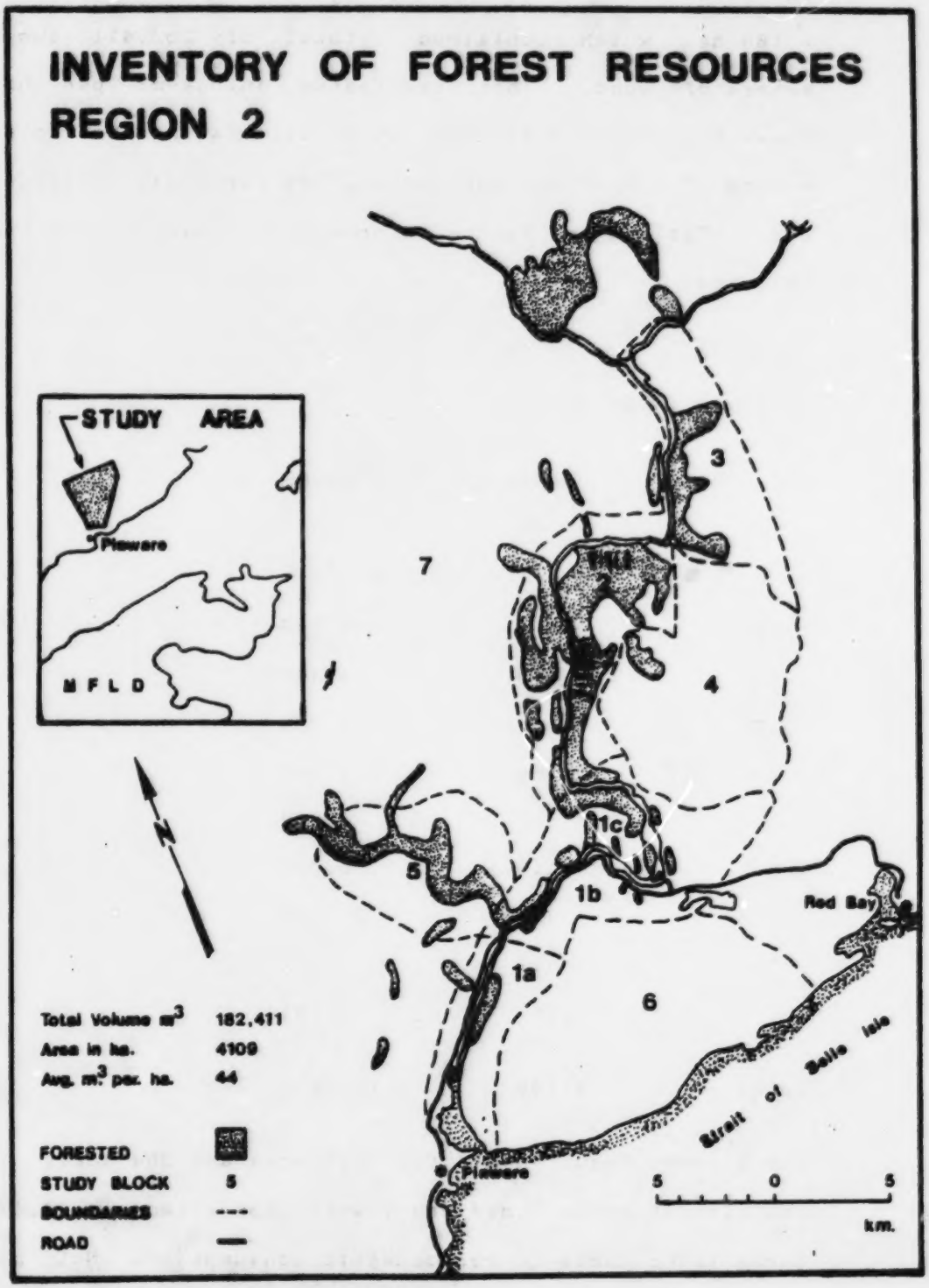

INVENTORY OF FOREST RESOURCES
REGION 2
STUDY AREA
Pinware
M F L D
N
7
3
4
11c
5
1b
1a
6
Red Bay
Strait of Belle Isle
Pinware
5 0 5
km.
Total Volume m3 182,411
Area in ha. 4109
Avg. m3 per. ha. 44
FORESTED
STUDY BLOCK 5
BOUNDARIES
ROAD

FIG. 2

The total area of merchantable timber was found to be 4,109 ha. which contained a total of 182,411 cubic meters of wood. This translates into 44m3 per ha. These figures were arrived at by calculating the total volume of timber and subtracting 30% for cull, wastage, etc.. Table 4 and Figure 2 provide a breakdown of the resource.

TABLE 4

REGION 2 INVENTORY

BLOCK#	AREA HA.	VOLUME m3
1A	94	5,339
1B	73	4,449
1C	311	19,764
2	1,666	114,949
3	107	6,030
4	116	6,226
5	376	25,573
6	nil	nil
7	1,366	81
Total	4,109	182,411

The present requirements for this area are 364 cords if the facilities in this study were converted and 4,130 cords (from Table 1) for domestic consumption. Not all

of the communities in this region were reviewed and it would not be unreasonable to raise the domestic consumption to 8,000 cords. This is a projected total consumption of 8,364 cords (1 cord equals 2.5 solid cubic meters approximately) or 20,910 cubic meters. The total inventory of the Pinware River is 182,411 cubic meters. If every tree was cut, there is only enough wood for 8.7 years and because of the inaccessible terrain it is estimated that this would be even less.

Region 3

Roddickton-Main Brook area, is a portion of the Department of Forest, Resources and Lands Forest Management Unit 18. The forest resources are managed by the Forest Management Unit Office in Roddickton.

The unit contains 387,639 ha. of land. Of this 131,922 ha..are classified as productive forest land. The remainder is 154,553 ha. of non-productive forest and 101,164 ha. of non-forested area.

The timber rights are administered by the Crown.

The area has been the subject of logging operations for domestic use, pulpwood and sawlogs for several hundred years. At present, the wood utilization is only for sawlogs and domestic use. There is no pulpwood operation due to the transportation costs to the market.

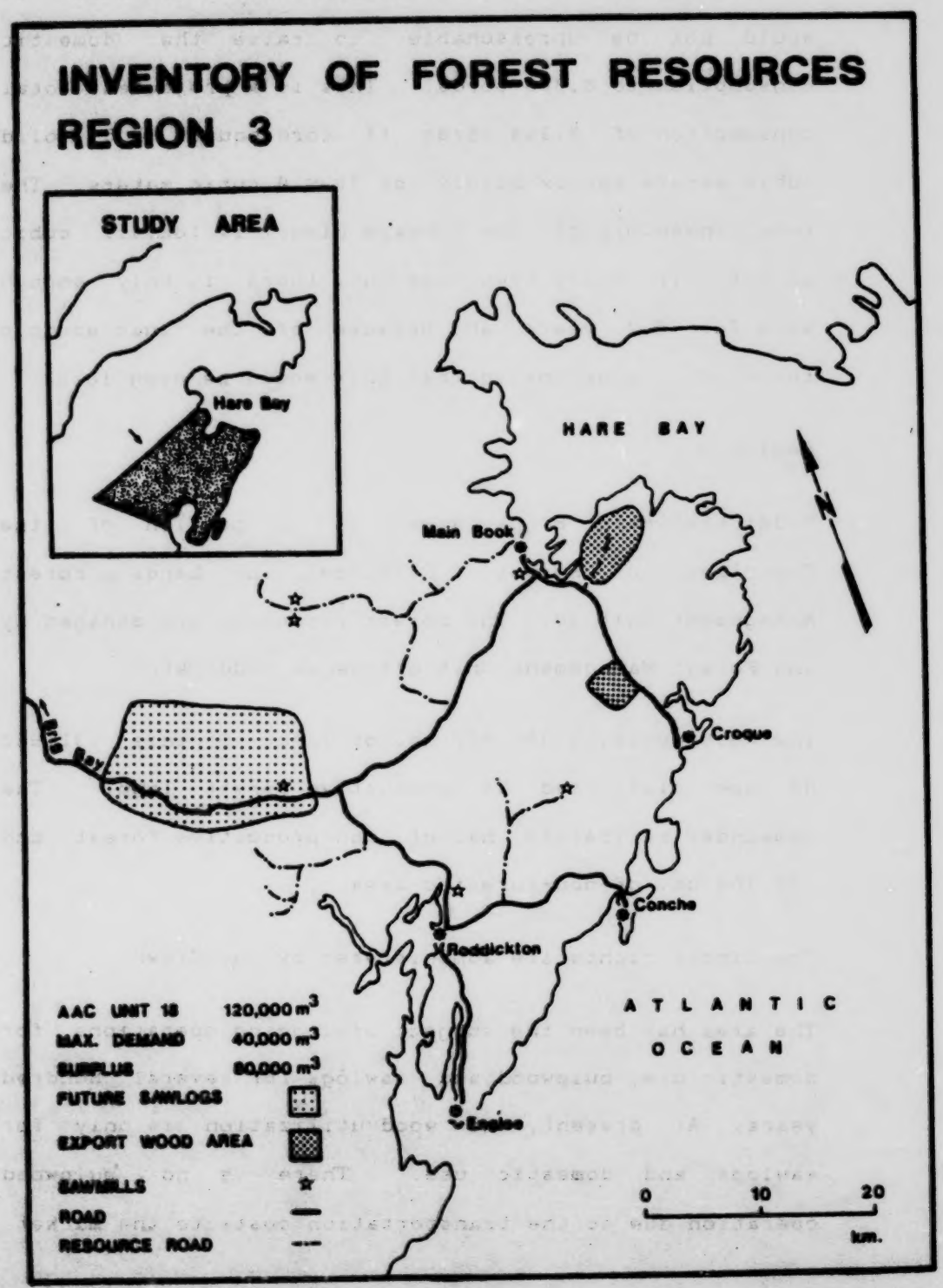

INVENTORY OF FOREST RESOURCES
REGION 3
STUDY AREA
Hare Bay
HARE BAY
Main Book
Croque
Conche
Roddickton
Engine
ATLANTIC
OCEAN
AAC UNIT 18 120,000 m3
MAX. DEMAND 40,000 m3
SURPLUS 80,000 m3
FUTURE SAWLOGS
EXPORT WOOD AREA
SAWMILLS
ROAD
RESOURCE ROAD
0 10 20
km.

FIG. 3

There are 5 main sawmills operating in this area. Figure 3 shows the planned operating areas for this Region. Any amount of firewood expected, by the unit forester, is to come from these areas.

The annual allowable cut for this region is 120,000 cubic meters and the present local demand is approximately 30,000-40,000 cubic meters. Any way that it is looked at there is a surplus of wood and the 655 cords or approximately 1,658 cubic meters required to supply the needs of these conversion facilities is easily supplied.

3.2 Supplier Review

In completing the forestry profile on the Regions, the commercial woods operators were evaluated. In this section the operating capabilities of the Regions are reviewed as follows.

Region 1 - There is only one operator in Region 1. Simon Strugnell of Port Hope Simpson operates a sawmill and boat building business under the name of Strugnell Woods Work and Boat Building. The woods operation is presently restricted to harvesting wharf sticks (6,000 20 ft. sticks per year) and sawlog material (100,000 fbm per year). The woods operation uses a horse for hauling.

Region 2 - There are no woods operators in this Region. However, Colon Doyle on the Island side of the ferry at St. Barbe has a woods operation as one of his various enterprises. He has considered supplying the Straits shore of Labrador with wood by operating a wood yard on the Island side. Also, the concept of trucking wood to Region 2 across on the ferry is a very promising operation.

Region 3 - There are four operators who supply wood in this Region. They are as follows:

1. Coates Lumber
2. B & L Construction
3. Pilgrams Sawmill
4. Alfred Weirs

These are all experienced operators and have supplied wood products to the Region for some time.

This supplier review provides some insight into the capabilities of each Region to supply firewood. More details on operational problems and costs will be dealt with in Section 5.2, Harvesting.

3.3 Port Hope Simpson

As part of the terms of reference of this study, the Port Hope Simpson area was to be considered as a regional firewood supply centre. This was investigated from five points of view as follows:

1. Markets
2. Wood supply
3. Transportation costs
4. Local interest
5. Economics

The markets for firewood from Port Hope Simpson have been determined from analyzing both commercial and domestic prospects. The supply is limited to ports which have adequate docking facilities to accommodate the CN Marine coastal boats. Figure 4 shows these ports.

The domestic market is obtained by taking 10% of the existing domestic wood consumption. This figure was arbitrarily arrived at based on the survey conducted for this study. It is recognized that traditionally firewood has been obtained by the user. However, many people such as teachers would rather buy wood if it were available. Only a trial will accurately determine the market, but from the people surveyed many said they would buy their wood or at least some of their requirements. A marketing procedure is discussed in Section 7.0 of this report.

The wood supply in Port Hope Simpson is adequate to supply the needs of the local area for many years. In determining just how long, the total known inventory must be divided by the projected demand. The present

inventory of wood is 7,254,000 cubic meters taken from Table 3 in Section 3.1 of this report.

The demand is the existing commercial operations and domestic cutting plus the future projected demand. There is one woods operation presently restricted to harvesting wharf sticks (6,000, 20 ft. sticks per year) and sawlog material (100,000 fbm per year) which is approximately 450 cords. In Table 1, the local firewood demand for the Region is approximately 2,690 cords. The projected domestic market is estimated to be at least 500 cords. The total demand is then 3,640 or approximately 9,100 cubic meters. A simple division would result in a wood supply for 797 years. Obviously there is no problem with wood supply in Port Hope Simpson.

The transportation of the wood can be accomplished by CN Marine Freighters. Discussions with Mr. Harold Taylor with CN Marine at Lewisporte revealed that it would be no problem during the regular summer and fall shipping season to transport wood. The wood would have to be in bundles of 2,000 lbs. or less to acquire the 1985 shipping rate of $1.08 /100 lbs. As well, cable slings would have to be provided for loading. Small amounts of wood could be stockpiled on the wharf at Port Hope Simpson for short periods or large amounts (1,000 cds or more) could be stock piled back of the wharf and

moved when the boat arrived. Either way, wood shipping from Port Hope Simpson is not new as the former Bowater Nfld. Ltd. shipped many thousands of cords from Port Hope Simpson. The potential ports of call are shown on Figure 4.

From several interviews of key people, the local interest can only be deemed as extremely good. Work is scarce in the Port Hope Simpson area and any new source of income would be welcomed. Also, there is no doubt that the Regional Rural Development Council would support any project of this nature.

The bottom line to any new venture is the economics. In this case it is easy to assess. The contractor in Port Hope Simpson has agreed that he can supply wood to the wharf for $50/cord. This figure falls in line with other delivered prices on the Island. More information on harvesting can be found in Section 5.2 of this report.

The shipping costs will vary because of the weight factor. However, since Port Hope Simpson has access to an abundance of burned dry wood which has a very low moisture content the shipping costs will be reasonable on a cord basis. A cord of dry spruce weighs in the vicinity of 3,000 lbs (a green cord of black spruce weighs 4,000-4,400 lbs as taken from Abitibi-Price check scales.). At the shipping rate of $1.00/100 lbs, this

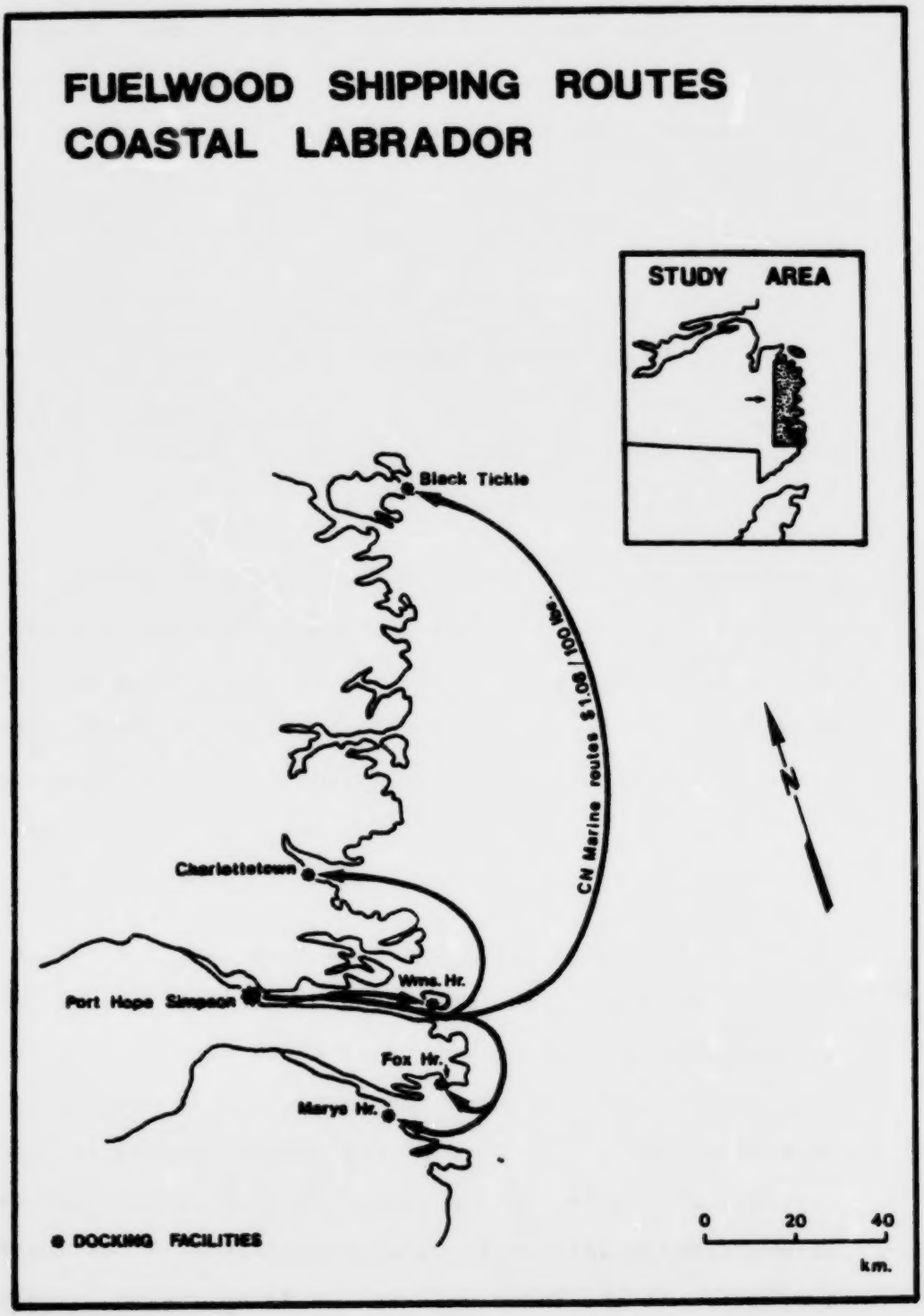

FUELWOOD SHIPPING ROUTES
COASTAL LABRADOR
STUDY AREA
Black Tickle
CN Marine routes $1.08 / 100 kg
Charlottetown
Wms. Hr.
Port Hope Simpson
Fox Hr.
Mary's Hr.
N
DOCKING FACILITIES
0
20
40
km.

FIG 4

means that one cord can be shipped to any port on the coast of Labrador for $32.40. The boat would not call for less than 50 cds but this means that a consumer could pick up his wood at the wharf for $82.40 per cord. No figure is given if the marketing went through a retailer but at least 20% mark up would be needed to handle the wood.

Considering that 10 cds would heat a average home for one year, the average heating costs would be $824.00 per year. From talks with several people who heat with oil, their heating costs are approximately $3,000. There is no doubt that the savings are realizable.

4.0 COMMUNITY ASSESSMENT:

The community assessment was accomplished by preparing a table to accommodate the pertinent information in a number form. The results provided a total score which finally provided a regional score. If one region had more buildings than another, a proportional weight factor was applied. Also, in Region 1 the R.C.M.P. building was not included because of its low conversion potential.

The criteria selected were not all judged to be of equal importance and hence a weight factor was applied. For instance the payback and wood harvesting criteria were assumed to be of more importance then the project

visibility. The weighing factor is based on 10 as the normal weight. A factor of 5 would mean that the criterion was considered to contribute half the weight as the 10 factor.

The final results show Region 1 as having the best conversion potential. The low wood cost at Port Hope Simpson and Charlottetown as well as the high overall stove oil prices contributed significantly to the final result.

It should be pointed out that if the conversion potential was looked at from the point of view of chip burning only the results would have been different. Region3 would have most likely been chosen. However Region 3 is very similar to areas of Newfoundland where wood chip burning has been tried on a small commercial sacle. Region 1 however offers a unique opportunity in that the a demonstration here applies to the whole coast of Labrador. An area where heating costs and unemployment are very high.

Table 5 shows the results of the community assessment in numerical form. The criteria selection for Table 5 are as follows:

10-Very Poor

20-Poor

30-Good

40-Very Good

50-Excellent

Oil Displaced litres

0-15,000	10
15,000-29,990	20
30,000-44,990	30
45,000-59,990	40
60,000-75,000	50

Payback

0-2	50
2.1-4	40
4.1-6	30
6.1-8	20
8.1-11	10

$/tonne

45-60	50
61-75	40
76-90	30
91-105	20
106-120	10

TABLE 5

Community Assessment

	INTEREST		BUILDING			PAYBACK	FUEL SUPPLY			GOVERNMENT		Does	TOTAL SCORE			REGION WEIGHT	REGION WEIGHTED
	Admin	Local	Access Storage	Furnace Operator	Furnace Condition		Distance	Avail.	Harvest.	Displaced	Potential Jobs	Visibil	Building	Community	Region	FACTOR	SCORE
WEIGHT	15	15	10	10	5	20	10	10	10	5	10	5					
COAST															41700	1	41700
Port Hope Simpson														14500			
Pentecostal School	600	600	500	400	50	600	500	500	400	100	300	100	4050				
Bayview Integrated	600	600	500	400	150	600	500	500	400	100	300	100	4050				
Grenfell Hospital	750	600	300	400	50	600	500	500	400	100	300	100	4700				
Mary's Harbour														8250			
St.Mary's School	600	600	400	400	100	600	300	300	300	100	300	100	4200				
Grenfell Hospital	600	600	600	400	50	600	300	300	300	100	300	100	4050				
Charlottetown														14700			
Grenfell Hospital	600	600	500	400	100	600	500	500	400	50	300	100	4050				
Charlottetown Inn	600	750	500	400	150	600	500	500	400	50	300	100	4050				
Pentecostal School	600	600	500	400	150	600	500	500	400	150	300	100	5000				
St. Lewis															38150	1	38150
St.Lewis School	450	600	600	400	150	600	300	300	200	150	300	100	4250	4250			
LABRADOR STRAITS																	
W.St.Modest																	
Our Lady Of Labrador	750	750	400	400	250	600	300	300	300	150	300	150	4050	4050			
Red Bay																	
Integrated School	450	600	400	400	150	400	300	300	300	50	300	150	3800	3800			
L'Anse au Clair														12200			
Northern Lights Inn	450	450	400	400	100	600	300	300	300	50	300	150	3800				
St. Andrew's Elementary	600	750	400	400	100	600	300	300	300	50	300	150	4250				
St.Pauls	600	750	400	400	300	600	300	300	300	50	300	150	4350				
Forteau														17300			
Elementary School	600	750	400	400	200	600	300	300	300	150	300	150	4450				
Mountain Field High School	600	750	400	400	100	600	300	300	300	150	300	150	4050				
Grenfell Health Center	150	450	400	400	50	600	300	300	300	50	300	150	3750				
R.C.M.P.	750	750	400	400	150								4450				
RODDICKTON/MAIN BROOK															49400	.810	40014
Main Brook																	
Elementary School	450	450	500	400	50	600	400	500	500	150	300	200	4700	4700			
Roddickton														19650			
Elementary School	450	600	500	400	100	600	400	500	500	150	300	200	4800				
Evely Collegiate	450	600	500	400	200	600	400	500	500	150	300	200	4800				
A.C.Palmer Acad.	600	600	500	400	150	600	400	500	500	250	300	200	5200				
Grenfell Hospital	600	450	400	200	250					150	300	200	4750				
Conche														8000			
Elementary School	600	600	500	400	100	600	400	400	400	200	300	150	4050				
Nursing Station	300	450	400	400	50	600	400	400	400	100	300	150	3950				
										50							
Side Arm						600	400	500	500	50	300	150	3950	3950			
Robert's Elementary	450	300	400	200	100									12300			
Englee																	
Englee Elementary	450	450	400	400	100	600	400	400	400	250	300	200	4350				
Englee Fish Plant	450	450	200	300	200	600	400	400	400	50	300	200	4150				
Municipal Building	300	450	300	300	50					100	300	200	3800				

5.0 COST ANALYSIS:

The Cost Analysis consists of two sections, conversion and harvesting, discussed in Sections 5.1 and 5.2 below.

5.1 Cost Analysis - Conversion

A payback approach was used in the cost analysis for the conversion of each building. Capital costs were divided by savings to determine the number of years to pay back the initial investment.

The analysis was first done at a screening level, to provide information to the decision matrix. These calculations are given in Appendix 2. Detailed calculations for coastal Labrador, the region selected, are given in Appendix 2 with the payback periods summarized in Table 5.1.

5.1.1 Calculation of Capital Costs

The capital costs consists of 4 items, additional building area, equipment, installation and contingency. The additional building area is required for wood storage and new equipment.

The annual oil use was taken from building records (e.g. from hospital or school boards) as provided to the Department of Mines and Energy or the consultants.

For this part of the analysis, an oil:wood ratio of 660 1 to 1 cord was used. This is based on the following calculation:

1 cord = 20×10^6 kJ

1 litre = 34.9×10^3 kJ

1 cord = 550 1

Oil furnace eff = 65%

Wood burner eff = 78%

$$1 \text{ cord} = 550 \times \frac{78\%}{65}$$

$$= 660 \text{ 1}$$

The cost of the addition was then calculated at $20/ft2. (This was increased to $30/ft2 for the detailed analysis.)

A chimney cost of $1600 for a one storey building, and $2600 for a two storey building, was added to this, if the existing chimney was inadequate. This cost is about the same whether the chimney is masonry or prefabricated insulated.

The costs of the equipment, including transportation plus installation and contingency cost were added to give a total installed capital cost.

5.1.2 Savings

The cost of the wood was calculated as described in Section 5.2. for the interim report analysis, the wood costs used were preliminary estimates as described in that report. Appendix 2 update the interim report tables for all three regions, using the new estimated wood costs.

The wood costs were subtracted from the oil costs to obtain savings per year.

Heat losses were calculated throughout by the degree day method.

5.1.3 Detailed Analysis - Coast

The screening level analysis of all factors indicated that the Coast was the preferred region for the demonstration analysis. Accordingly eight of the most likely buildings in that region were examined in more detail. These were

Port Hope Simpson

- Pentecostal school
- Bayview Integrated School
- Grenfell Hospital

Charlottetown

- Grenfell Hospital
- Charlottetown Inn
- Pentecostal School

Mary's Harbour

St. Mary's School

St. Lewis (Fox Harbour)

St. Lewis All-Grade

Building layouts were prepared for each building, based on information from site notes and photographs. Brief specifications were prepared and costs were estimated. The specifications, layouts and cost analysis on the suggested conversion facilities are included in Appendix 1. The site notes and photographs of all buildings studied are presented in Appendix 4.

Two cases were analyzed. In Case 1 large units were used to minimize oil consumption. In Case 2, the units were smaller (but still could meet the peaks), and backup oil use was higher.

In the first case, the burning units were sized to provide twice the heat loss at -10oF (-23oC) plus 20%. The storage units were sized to match this; that is, to store all excess heat produced at -10oF. Using this criterion, it turns out that no oil burning is required at 14oF, the mean daily January temperature at Battle Harbour Mary's River.

In the second case, smaller burning units and storage tanks were used, thus reducing capital costs. The burning units were sized to meet the heat loss at -20oF

(-29oC) (a temperature which, for example, only occurred once in 7 years at Daniel's Harbour) plus 25%. The storage units were sized to match the heat output as in Case 1, and were correspondingly smaller. At the mean daily January temperature, about 12 hours of storage is available after 8 hours of burning.

To determine what additional oil would be burned at lower temperatures, the distribution of hourly temperatures at Daniel's Harbour was used. Two temperature scenarios were considered for each case. Scenario a used the Daniel's Harbour data directly Scenario b used the same frequency distribution but assumed that temperatures are 10oF colder on the Coast. The difference in mean winter temperature between Daniel's Harbour and Battle Harbour Mary's River is 7oF, and 8oF between the mean daily minimums. Daniel's Harbour extreme of record, however, is 6oF colder. Using a difference of 10oF rather than 7o or 8o provides a slightly more conservative estimate of oil consumption.

5.1.4 Results

The simple payback periods for the four cases are shown in Table 5.1. Complete calculations are given in Appendix 2, together with details of an example system sizing.

Payback periods range from about 6 years for the Grenfell Hospital in Charlottetown to over 9 years for the schools in Mary's Harbour and St. Lewis. The higher wood costs in these 2 communities result in longer payback periods.

The Daniels Harbour temperature scenario in both cases is probably rather optimistic because it is clearly colder on the Labrador Coast than at Daniel's Harbour. However, low oil consumption may result from other causes, in particular from better performance of the units than has been assumed.

In one or two cases there is no additional oil required even in temperature scenario. This situation occurs because occasionally in a particular situation the units must be substantially oversized in order to meet the criterion.

With temperature scenario a, the paybacks always decrease with the smaller installation. Smaller units not only mean lower costs for the units and buildings themselves, but also for the additional building area. The cost of the extra oil burned is relatively low.

With the more conservative amounts of oil burned in scenario b, the payback periods are still usually shorter with the smaller installation. Two exceptions are the Grenfell Hospital and the Charlottetown Inn,

Charlottetown. The capital costs in these two installations are lower because no additional buildup area is requied. Existing basements are presently unused except for furnaces. In other cases it is a function of the particular size of units and fuel consumption.

Clearly at this level of study these calculations are only approximate, but they do show the range of paybacks which might be expected under different conditions.

5.1.5 Recommendations

It is recommended that the 3 buildings with the shortest paybacks in the Case 2b scenario be investigated in more detail. Case 2b is probably the most realistic; the capital investment is not as high as in Case 1, and the amount of oil burned is the most conservative of all the 4 scenarios. If the units perform better than the analysis has assumed, the savings will simply be higher. The economic analysis indicates that in general it is better to burn extra oil on the coldest days than to invest in a larger installation. If oil costs use, or if additional units are desired for other reasons, extra burners and/or tanks can be added in the future.

The detailed investigation for the selected buildings should consist of the following tasks.

1. Confirm interest of administration and availability of stoker.

2. Obtain (or draw up) plans of the building and the existing heating system, including the insulation, area of windows, and heat distribution system.

3. Size the system and design the required building addition using the detailed information from Task 1.

4. Obtain firm prices for equipment, building addition, and wood fuel.

5. Re-evaluate economics.

Table 5.1
Summary of Simple Payback Periods
(Years)

	Case 1		Case 2		Rank
	a	b	a	b	(from 2b)
Pentecostal School Port Hope Simpson	7.8	8.1	6.8	7.6	4
Bayview Integrated Port Hope Simpson	8.5	9.8	7.2	9.1	6
Grenfell Hospital Port Hope Simpson	8.6	8.7	6.5	7.1	3
St. Mary's School Mary's Harbour	11.2	11.4	9.6	11.8	7
Grenfell Hospital Charlottetown	6.2	6.2	5.7	7.1	1
Charlottetown Inn Charlottetown	7.2	7.2	6.6	7.3	3
Pentecostal School Charlottetown	8.8	9.3	7.4	8.9	5
St. Lewis- Allgrade St. Lewis	10.3	10.8	9.4	11.7	8

Case 1: Larger installation; no oil required in mean January temperature.

Case 2: Smaller installation; meets peaks but additional oil required.

Temperature Sequence (a): Daniel's Harbour 7 year hourly temperatures used to determine oil burned.

Temperature Sequence (b): Daniel's Harbour temperature distribution but 10oF colder.

Although the payback periods are longer than those shown in the interim report, these increases are due to factors which would apply to all regions, and so are not likely to affect the selection of region.

5.2 Harvesting

A profile of the present state of the art of wood harvesting is presented for each community in Tables 6 & 7. The information has been summarized from a questionnaire carried out to 2-5 informed people in each community. The questionnaires on which the data was collected are included in Appendix 4.

In Tables 6 & 7 the rating systems are as follows:

E excellent

G good

F fair

P poor

Y yes

N no

S&T Harvesting of wood with a ski-doo and pick-up truck

TABLE 6

HARVESTING

Ca	PLACE	DOM	CONT	SKID	FOR	AIR	WELD	GAS/LT	$LAB/HR	ROADS
R1	Charlottetown	S&T	N	N	N	N	Y	.72	7.00	P
R1	Port Hope Sim	S&T	1	Horse	N	N	Y	.72	7.00	G
R1	St. Lewis	S&T	N	N	N	N	Y	.72	7.00	P
R1	Mary's Harbou	S&T	N	N	N	Y	Y	.72	7.00	P
R2	Red Bay	S&T	N	N	N	N	N	.63	7.00	P
R2	West St. Mode	S&T	N	N	N	Y	Y	.63	7.00	P
R2	L'Anse au Lou	S&T	N	N	N	N	N	.63	7.00	P
R2	L'Anse au Cla	S&T	N	N	N	Y	Y	.63	7.00	P
R2	Forteau	S&T	N	N	N	N	N	.63	7.00	P
R3	Main Brook	S&T	3	Y	N	Y	Y	.60	7.00	E
R3	Roddickton	S&T	3	Y	N	Y	Y	.60	7.00	E
R3	Conche	S&T	N	N	N	N	N	.60	7.00	F
R3	Bide Arm	S&T	N	N	N	N	N	.60	7.00	G
R3	Englee	S&T	N	N	N	Y	Y	.60	7.00	G

Dom	Domestic harvesting method
Cont	Number of woods contractors
Skid	Skidders available
For	Forwarders available
Air	Compressed air available
Weld	Welding available
Gas/lt	Gasoline price per litre

$Lab/hr Labour rate per hour

Roads Road condition in the area

TABLE 7

SCIØ-ECONOMIC

Ca	PLACE	INTEREST BURNING	REACTION CUTTING	DEL$/CORD
R1	Charlottetown	G	G	50
R1	Port Hope Simpson	G	G	50
R1	St. Lewis	G	G	100
R1	Mary's Harbour	G	G	100
R2	Red Bay	E	E	100
R2	West St. Modest	E	E	100
R2	L'Anse au Loup	E	E	100
R2	L'Anse au Clair	E	E	100
R2	Forteau	E	E	100
R3	Main Brook	G	G	65
R3	Roddickton	E	G	65
R3	Conche	G	G	75
R3	Bide Arm	G	G	65
R3	Englee	G	G	70

Interest Burning - Overall interest in burning wood

Reaction Cutting - Overall reaction to cutting more wood

Del$/Cord - Delivered price of a cord of wood

Tables 6 & 7 provide an overview of the wood harvesting capibilities of each region in the study. However, the following provides a more indepth analysis of the problems and costs associated with each region.

Region 1 - In this region the woods operations are for the most part domestic. Local people cut there own firewood. In the Port Hope Simpson - Charlottetown area there is no problem getting wood. However, in Mary's Harbour and St. Lewis the men and ski-doos must travel 20 miles in the country towards Port Hope Simpson to obtain wood.

The commercial operation is limited to only one operator. Simon Strugnell of Port Hope Simpson operates a sawmill and boat building business under the name of Strugnell Woods Work and Boat Building. His woods operation is presently restricted to harvesting wharf sticks and sawlog material. He is, however, very interested in pursuing the firewood market.

Mr. Strugnell presently operates on a small scale with one horse for harvesting. He cuts his wood about nine miles up the Alexis River and floats it down as necessary. He feels that he could cut quite a bit of firewood in this manner and no doubt he could.

However, a road exists into stands of dry wood. This road was left over from the old Bowater days. At

present, it needs some repair. For large scale woods operation, the road would have to be repaired and quite possibly the contractor would need to upgrade to mechanical harvesting.

In assessing the costs of obtaining wood, the Region has to be divided into two areas.

In the Port Hope Simpson-Charlottetown area, wood could be obtained from local men in the winter or from the contractor in Port Hope Simpson. Local men said they would deliver and stack in a cord of firewood for $50. The Contractor said the same. In the case of Charlottetown, there is no contractor but wood could be obtained from local men.

In the Mary's Harbour-St.Lewis area, the wood could be supplied by local men. As mentioned earlier, the wood comes from 20 miles away and it wood cost $80 per cord to buy it locally. For an institution it would cost another (2 hours labour at $7.00/hr plus $6.00 for chain saw hire) $20 per cord to get it cut up and stacked in a shed. In this area, it would be almost as inexpensive to buy the wood from the contractor at Port Hope Simpson and much more reliable. The wood cost for this area has been set at $100/cord stacked in a shed. Local institutions may find cheaper methods to obtain wood but this provides a good budget figure.

Part of this study was to assess the potential for harvesting woodchips. There are several problems with this.

1. Chipping burned wood is very hard on any chipper.
2. The cost of shipping the chipper from place to place for small amounts of wood is expensive.
3. The problem of sharpening chipper knives without the services of a machine shop.
4. Chipping would have to be done in the summer because of the large amounts of snow accumulations in the winter, and the shed built to handle the chips would have to be twice the size to handle the same amount of roundwood.
5. The present burning systems require manual feeding so there is no gain over hand feeding firewood.

Because of the problems with the harvesting end of the operation, the concept of chipping on the isolated coast of Labrador was not considered as an alternative for wood burning.

Region 2 - This region does not have any major source of wood which is accessible hence there are no woods operators in this region. The only major source of wood is in the Pinware River valley which has been outlined in Figure 2. For the most part it is small wood but would supply some of the area.

However, Colon Doyle on the Island side of the ferry at St. Barbe has a woods operation as one of his various enterprises. He has considered supplying the Straits shore of Labrador with wood by operating a wood yard on the Island side. No activity has started on this concept to date.

The concept of trucking wood to Region 2 across on the ferry is a very promising idea and has been used in this section to project costs to supply the buildings studied with wood.

It has been well established that firewood costs $50 per cord delivered to an enduser in this section of the northern peninsula. To ferry a tractor across to the Labrador Straits side in 1983 cost $99.50. This will increase to near $115.00 in 1985. For a tractor trailer carrying 15 cords this would mean a $230.00 cost for the two way trip or $15.33 per cord. On the straits side there would involve some transportation and off-loading time. As well, the receiving building would have to cut the wood to 2 ft lengths and stack it in the storage shed. This cost is calculated as follows $10.00 for trucking and unloading (based on an average haul of ten miles in local logging operations) and $25 to cut and store in the shed (2.5 hrs x $7.00/hr labour + $7.50 chainsaw rental). This gives an approximate cost of $100.00 per cord. The cutting and storage cost is more

in this area because the people are not likely to be experienced in woods work.

Wood can also be purhased locally from people who cut domestically in the Pinware area. Discussions revealed that the delivered cost would be $40 per pickup load which would be $80 per cord. These people would likely cut up and stack in for $20.00 per cord. The cost would be the same as buying wood from the Island but delivery would not likely be very reliable.

There is another factor which affects the wood supply capabilities of this area, that is, the road system which accesses the Pinware River valley. There is 2 km of road at present and the nearby forest has been cut out. More road has been planned for this area but with the domestic wood load for the region of 4,130 cords per year, this only includes the communities reviewed for this study, the wood resource will be cut in short order. For a long term sustained supply wood will have to come from the Island.

The use of woodchips is restricted in this region by the same factors which affect Region 1.

Region 3 - This Region has an abundant supply of wood and experienced contractors who supply wood at present for domestic use. There are four major operators who supply wood in this region. They are as follows:

1. Coates Lumber
2. B & L Construction
3. Pilgrams Sawmill
4. Alfred Weirs

Costing wood supply for this region was straightforward. The contractors all supply wood for $50 dollars per cord. In Main Brook, Roddickton and Bide Arm, the delivered cost for 2 ft wood stacked in a shed is $65.00 per cord. An extra cost of $15.00 per cord was added to the contractors cost for the extra cross cutting and stacking. Conche and Englee is further away from the main base of contractors and an extra $10.00 and $5.00 respectively was added for trucking. Prices may vary because a local domestic may agree to cut the wood for less.

As far as woodchipping is concerned if any region has potential this area has the most. There is no doubt that on a large scale it would be most economic. However, the success of providing chips on a small scale to many small endusers has not met with much success. It is recommended that space heating with woodchips in small buildings be considered only after a large commercial chip burning operation is successfully estabished. At this point only solid wood burning is recommended.

6.0 WOOD HEATING SYSTEMS:

The major criterion for a wood heating system in the regions under consideration is that it must be simple to use. Most of the buildings are schools and hospitals, without full time maintenance staff. Janitors are available for occasional simple tasks, like stoking, but they have other duties, and only work a day shift, usually 6-8 hours.

The system must, therefore, be self-feeding, or only require occasional stoking (e.g. 2-3 times/day). Ordinary wood burning furnaces can therefore not be used. The fuel supply must also be conveniently located, so that if necessary a teacher or nurse could stoke.

The two systems considered were

1. automatic-feed woodchip burner
2. heat storage wood furnace

6.1 Automatic Feed Woodchips

A number of automatic feed woodchip burning systems are available. Unfortunately for small installations such as these, there are problems with chip supply, especially on the Coast (see discussion in Section 5.2). They also usually have some type of hopper arrangement, and someone must still load the hopper at least once or twice a day. It was, therefore, agreed that for the present analysis, chip systems would not be considered.

The Roddickton/Main Brook region may offer more potential for woodchip burning systems, and if similar projects are installed in that area, woodchips should be reconsidered. Some manufacturers' information on such systems is given in Appendix 3.

6.2 Heat Storage Systems

A new type of combined wood furnace/hot water storage system is now available. Ordinary roundwood in pieces up to 6" (15 mm) diameter and 2' (0.6 m) long is burned in a very hot fire in a turbulent atmosphere. The well-insulated water-filled heat storage tank holds the heat until it is needed.

The hot-burning fire, which burns all the creosote and gases, has several advantages.

- It is more efficient than an ordinary wood stove or furnace, because combustion is complete. Less wood is therefore required.

- Emissions are very clean. Much less chimney cleaning is required than with other wood furnaces, and the danger of chimney fires is greatly reduced. There is also no pollution from harmful wood gases.

The advantages of storing the heat in a tank are

- few stokings required (e.g. in the morning and evening)

- controlled heat delivery. Heat is delivered to the building by the conventional hot water or hot air system, controlled by thermostats.

For reasons of convenience and safety, therefore, this type of system was selected. Design and costing was based on the Tempest unit manufactured by Dumont Industries. A similar system is made by Jetstream, but it is not available in a large enough size. Manufacturers' literature for both these units is given in Appendix 3. Tempest boilers are available in 2 sizes, 130 MBTU (38 kW) and 350 MBTU (103 kW) per hour.

7.0 IMPLEMENTATION PLAN:

The implementation plan for instituting the recommendations of this study are in two sections.

1. Conversion Plan
2. Port Hope Simpson Wood Supply Infastructure

7.1 Conversion Plan

In obtaining management approval to convert the buildings studied, each of the responsible managers were contacted. They are as follows:

1. Mr. Sandy Campbell-Charlottetown Inn
2. Mr. Rex Hillier- St.Anthony Integrated School Board for St. Mary's Integrated School, St. Lewis School and Bay View Integrated School in Port Hope Simpson.
3. Mr. Albert Sheppard-Grenfell Hospital Association St. Anthony for the Grenfell Hospitals at Port Hope Simpson, Mary's Harbour and Charlottetown.
4. Mr. Bob Paddock-Pentecostal School Board in Windsor for the Pentecostal schools at Port Hope Simpson and Charlottetown.

After discussions with each manager, the same conclusions were reached. They are interested if the savings are there. Also, some money may be available depending on the savings realizable. It is estimated that obtaining full approval from all levels of management would take three months.

If these conversions are to take place in 1985, it is very important that the involved managements be contacted in early March. The various school boards are not as readily accessible after school closing in June.

In terms of the contribution level, it is suggested that a 50-50 sharing level be considered between the various managements and government on hardware purchases. The savings are such that any management could easily justify the capital expenditures involved. Since, it is a trial the government should consider carrying the cost of the consulting services required.

In relation to the actual hardware, the ideal time to convert the facilities is in July and August for several reasons. One, the schools are closed for the summer season. Two, the coastal boat service is most reliable to the area. Three, weather is reasonably predictable for travelling to conversion sites.

If the conversions were to take place, a trip by the consultant and the installation contractor is recommended to determine exact details of the conversion.

The wood supply would have to be stored in by September 30th of any year. To achieve this, wood will have to be cut in the winter of the previous year or in the summer. It is suggested that wood can be obtained cheaper than

the prices quoted in this study for the individual facilities. For instance, the caretaker or an employee who may be off at some points may take a contract to supply the wood. The supply should be left flexible initially to encourage competition among local people since unemployment is so high at some periods of the year. At any rate the small volumes of wood required would not be a problem to obtain.

The following steps are required to finalize the actual conversion process.

1. Discuss conversion with the appropriate school or hospital board, to determine their level of interest. Most new projects require interest and support from the owners to make them successful demonstrations. Confirm that someone is available to stoke.

2. Obtain plans of the buildings being considered, including information on present distribution system, domestic hot water system and the like.

3. Do an energy audit to determine whether other improvements to reduce heat losses can be done at the same time (e.g. basement insulation).

4. Select final systems type and size. Talk to users of similar systems.

5. Size the system and design the required building addition.

5. Obtain firm estimates for all necessary components, installed (e.g. draft booster, heat exchanger, additional piping and for building addition).

6. Re-evaluate payback.

7. Contact interested agencies for funding commitments such as The Department of Mines and Energy, The Newfoundland and Labrador Rural Development Council, the Department of Public Works, the Department of Education and various building managements.

7.2 Port Hope Simpson Wood Supply Infrastructure

To supply large amounts of wood to the coast from Port Hope Simpson, the work would have to be done in the summer on the CN Marine coastal freighters. A selling job would have to be done in the various communities to initiate a market. Also, local retailers should be encouraged to buy wood for sale and potential customers should be encouraged to give orders.

The system could be set up through a contractor such as Simon Strugnell of Port Hope Simpson. However, he would not be able to wait for his money and would prefer to have the wood delivered to dockside and be paid for it. A good method to handle the delivery is for a local agency such as the Rural Development Council to act as a

marketing board . They could buy wood at dockside from whoever would supply. Also, because the council covers the entire coastline it could easily obtain orders in various communities.

Since, there is a RC (Resistance to Change) Factor in most new enterprises it will most likely be necessary to have a supply of wood available in each community for sale in the first winter. There are times when people would rather buy a load of wood then go and cut it.

At present if the facilities suggested in this study are converted there is a market for 313 cords. It would not be inconceivable that the market could reach 1,000 cords. Port Hope Simpson has dry wood available now and that is a big factor.

6.0 CONCLUSIONS:

In addressing the terms of reference of this study, the following conclusions are offered.

1. Region 1 or Labrador Coast has the most overall potential for successsful wood conversions in the buildings reviewed. The buildings with the best payback potential are the Grenfell Hospital in Charlottetown, the Charlottetown Inn, the Grenfell Hospital in Port Hope Simpson and the Pentecostal School in Port Hope Simpson. The Pentecostal School may be to large for a demonstration conversion.

2. All three regions offer good potential for conversion to wood burning.

3. Wood supply is not a problem in any region if wood is trucked from the Island for Region 2.

4. Wood chipping is not considered to be a viable alternative in coastal Labrador and solid wood heating should only be considered.

5. The Port Hope Simpson area has a good potential for the export of firewood to the coast of Labrador.

9.0 RECOMMENDATIONS:

As a result of completing this study the following recommendations are made:

1. That the buildings with the best paybacks be considered for final analysis for conversion to wood burning.
2. The management of other facilities in Regions 2 & 3 be made aware of the potential savings of burning wood.
3. Work on conversion should start as soon as possible but should not be delayed past early March if the conversions are to be realized in 1985.
4. A trial be conducted in 1985 to supply firewood to outlining communities on the coast of Labrador from Port Hope Simpson.

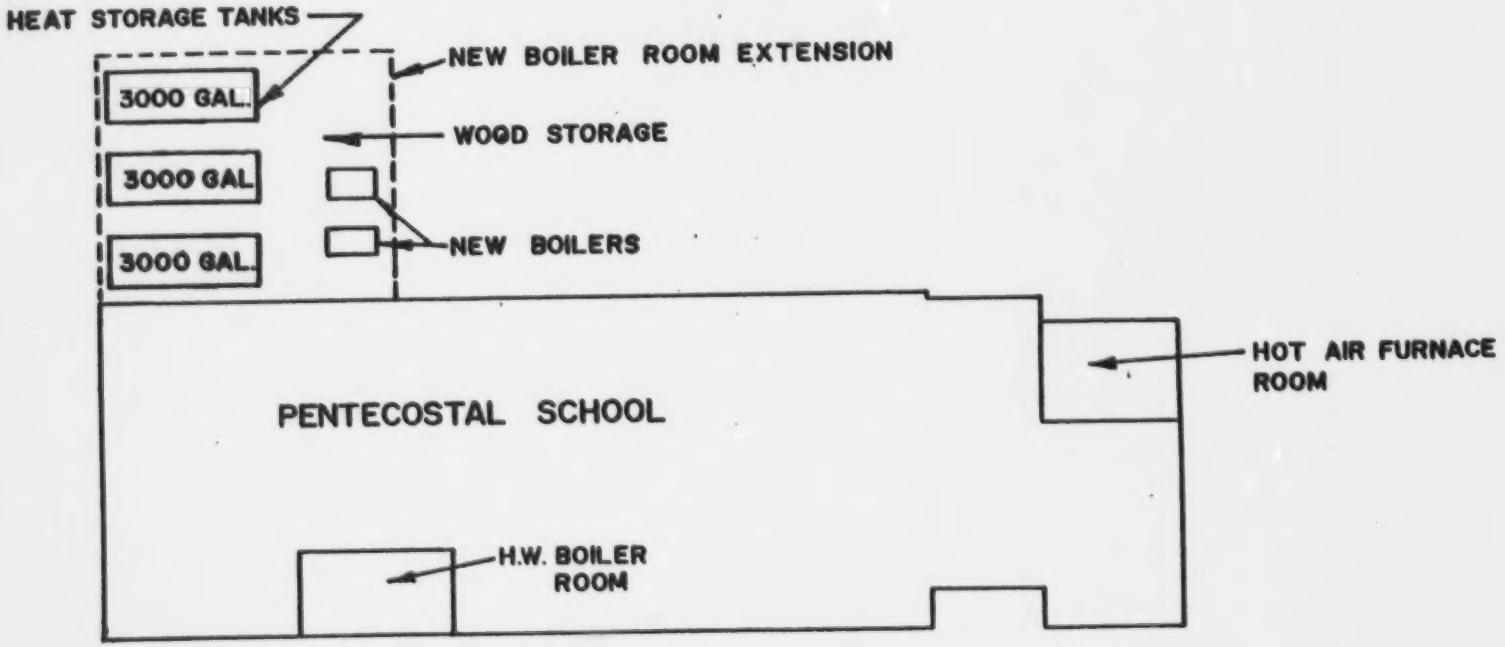
10. BIBLIOGRAPHY

Brador-Remote Community Demonstration Program-Newfoundland Overview Study-1984

Dept. of Mines and Energy-Annual Cost of Fuel and Utilities Nfld. and Labrador 1984-Nfld. Statistics Agency-Sept.1984

APPENDICES

APPENDIX 1: Building Plans and Conversion Costs



PENTECOSTAL SCHOOL PORT HOPE SIMPSON
SITE PLAN

CAPITAL COST ESTIMATE CASE: 1

Location: Pentecostal School
Port Hope Simpson

Floor Area of Building	13,000 ft2	1,209 m2
Boiler Size	830,000 BTUH	243 kW
Heat Storage Tank Size	10,500 us gal	39743 litres
Additional Building Area Required	1,300 ft2	121 m2

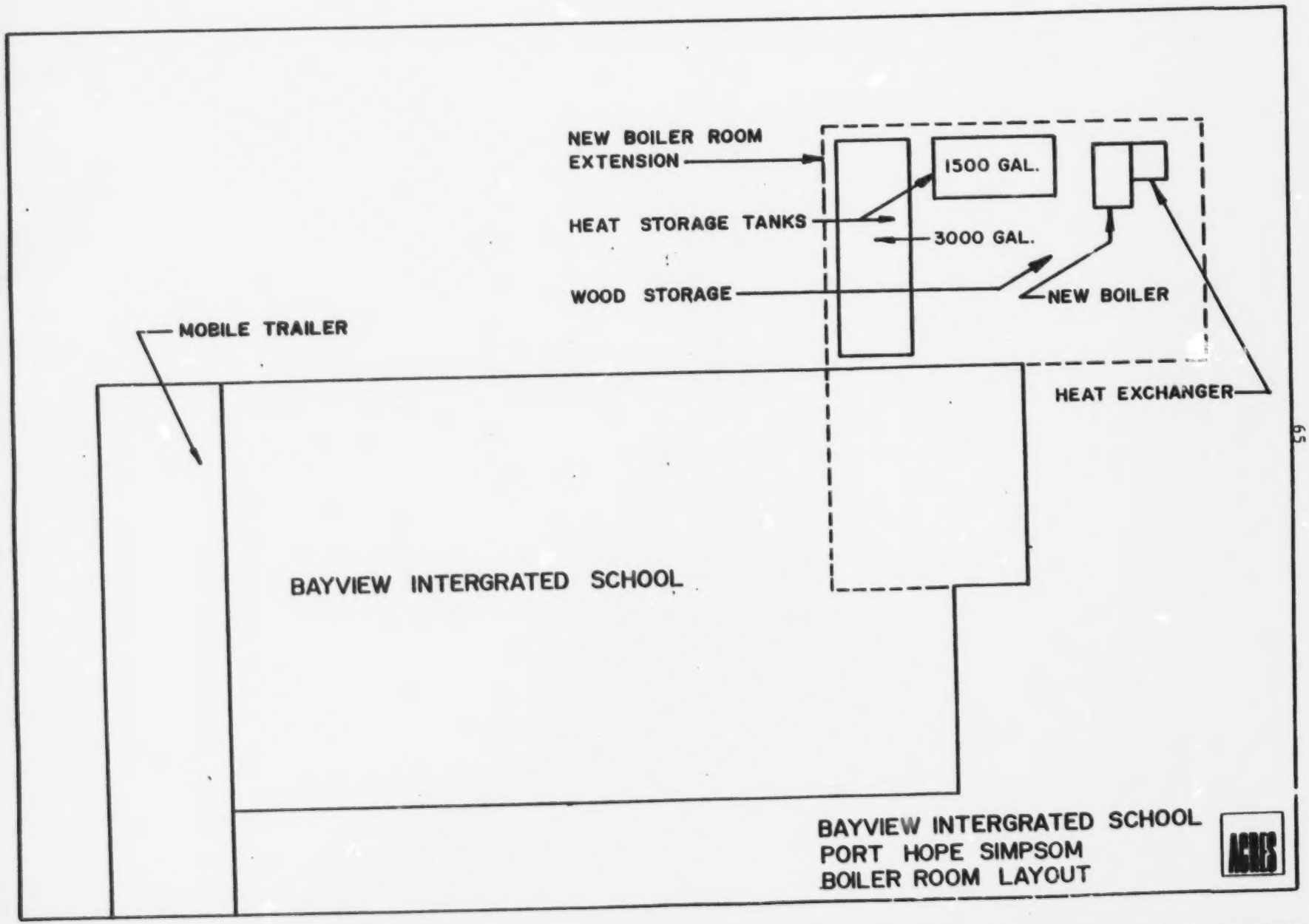
Boiler		$15,695
Heat Exchanger		N/A
Heat Storage Tank		$12,700
Building Extension	(1300*$30)	$39,000
Building Improvements		$500
Chimney		$1,600
	Subtotal	$69,495
Installation and Misc. 10%		$6,950
Contingency 15%		$11,467
Total Installed Capital Cost		$87,911

CAPITAL COST ESTIMATE CASE: 2

Location: Pentecostal School
Port Hope Simpson

Floor Area of Building	13,000 ft2	1,209 m2
Boiler Size	700,000 BTUH	205 kW
Heat Storage Tank Size	9,000 us gal	34065 litres
Additional Building Area Required	1,100 ft2	102 m2

Boiler	$12,460
Heat Exchanger	N/A
Heat Storage Tank	$11,600
Building Extension (1100*$30)	$33,000
Building Improvements	$500
Chimney	$1,600
Subtotal	$59,160
Installation and Misc. 10%	$5,916
Contingency 15%	$9,761
Total Installed Capital Cost	$74,837


NEW BOILER ROOM
EXTENSION
1500 GAL.
HEAT STORAGE TANKS
3000 GAL.
WOOD STORAGE
NEW BOILER
MOBILE TRAILER
HEAT EXCHANGER
BAYVIEW INTERGRATED SCHOOL
BAYVIEW INTERGRATED SCHOOL
PORT HOPE SIMPSOM
BOILER ROOM LAYOUT
ACRES

CAPITAL COST ESTIMATE CASE: 1

Location: Bayview Integrated
Port Hope Simpson

Floor Area of Building	4,880 ft2	454 m2
Boiler Size	480,000 BTUH	141 kW
Heat Storage Tank Size	6,500 us gal	24603 litres
Additional Building Area Required	819 ft2	76 m2

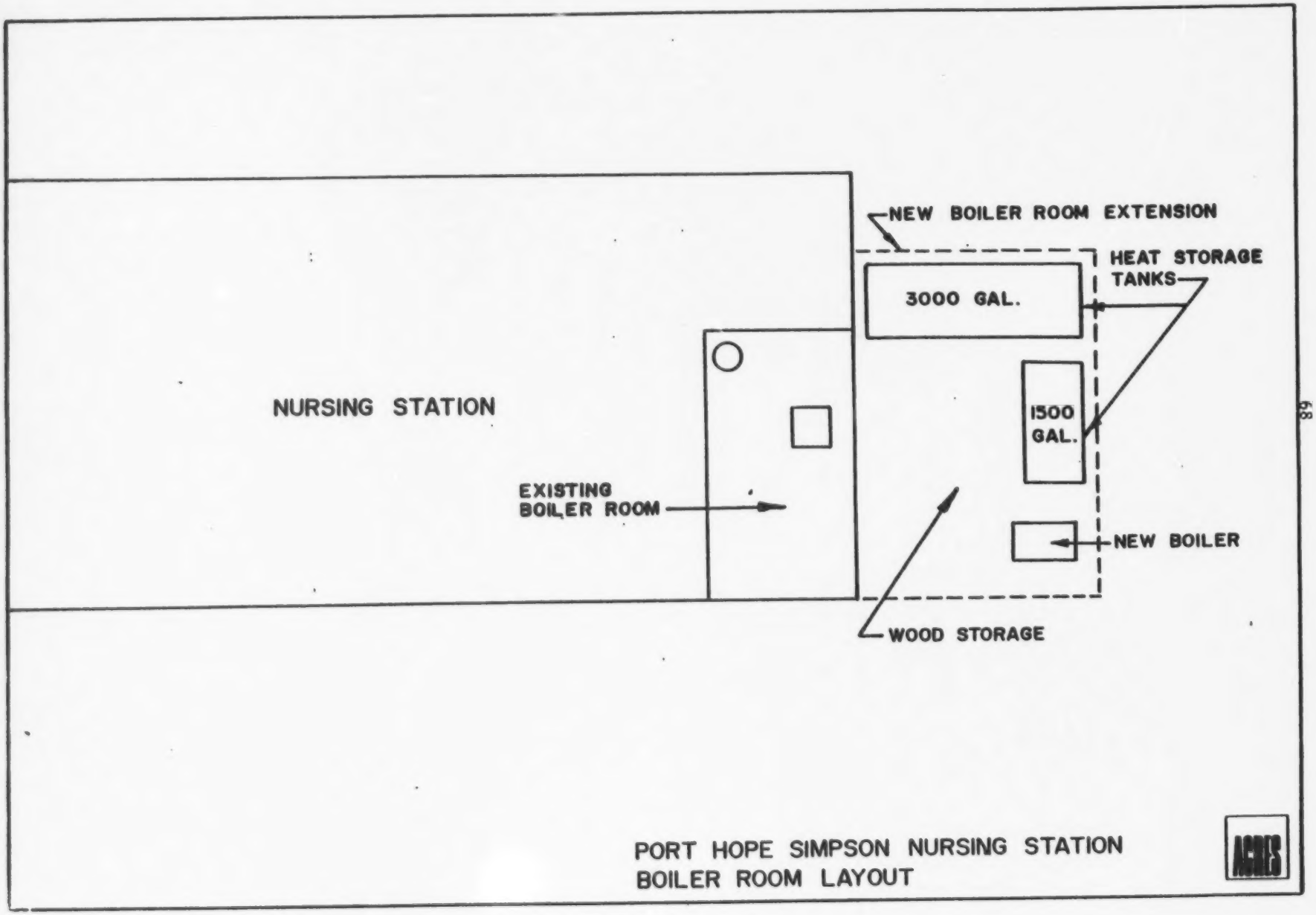
Boiler		$10,055
Heat Exchanger		$1,800
Heat Storage Tank		$8,600
Building Extension	(819*$30)	$24,570
Building Improvements		$500
Chimney		$1,600
	Subtotal	$47,125
Installation and Misc. 10%		$4,713
Contingency 15%		$7,776
Total Installed Capital Cost		$59,613

CAPITAL COST ESTIMATE CASE: 2

Location: Bayview Integrated
Port Hope Simpson

Floor Area of Building	4,890 ft2	454 m2
Boiler Size	350,000 BTUH	103 kW
Heat Storage Tank Size	4,500 us gal	17033 litres
Additional Building Area Required	586 ft2	54 m2

Boiler		$6,730
Heat Exchanger		$1,800
Heat Storage Tank		$7,400
Building Extension	(586*$30)	$17,580
Building Improvements		$300
Chimney		$1,800
	Subtotal	$35,610
Installation and Misc. 10%		$3,561
Contingency 15%		$5,876
Total Installed Capital Cost		$45,047



PORT HOPE SIMPSON NURSING STATION
BOILER ROOM LAYOUT

ACRES

CAPITAL COST ESTIMATE CASE: 1

Location: Grenfell Hospital
Port Hope Simpson

Floor Area of Building	3,284 ft2	305 m2
Boiler Size	480,000 BTUH	141 kW
Heat Storage Tank Size	6,500 us gal	24603 litres
Additional Building Area Required	799 ft2	74 m2

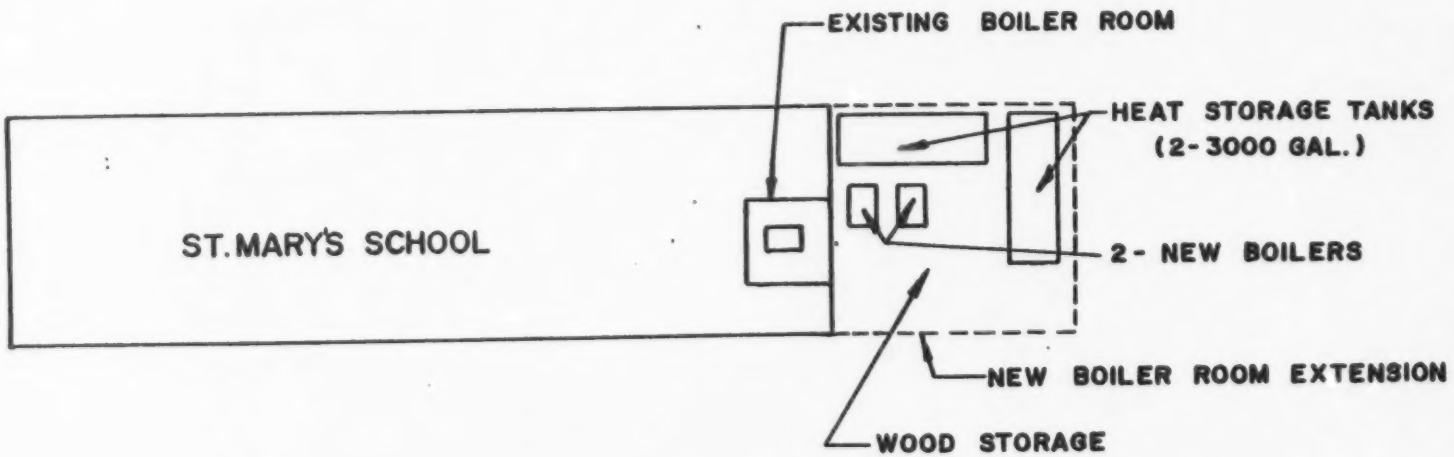
Boiler		$10,055
Heat Exchanger		N/A
Heat Storage Tank		$8,600
Building Extension	(799*$30)	$23,970
Building Improvements		$300
Chimney		N/A
	Subtotal	$43,125
Installation and Misc. 10%		$4,312
Contingency 15%		$7,116
Total Installed Capital Cost		$54,553

CAPITAL COST ESTIMATE CASE: 2

Location: Grenfell Hospital
Port Hope Simpson

Floor Area of Building	3,284 ft2	305 m2
Boiler Size	350,000 BTUH	103 kW
Heat Storage Tank Size	4,500 us gal	17033 litres
Additional Building Area Required	565 ft2	53 m2

Boiler		$6,730
Heat Exchanger		N/A
Heat Storage Tank		$7,400
Building Extension	(565*$30)	$16,950
Building Improvements		$500
Chimney		N/A
	Subtotal	$31,580
Installation and Misc. 10%		$3,158
Contingency 15%		$5,211
Total Installed Capital Cost		$39,949



MAIN ROAD

ST. MARY'S SCHOOL, MARY'S HARBOUR
BOILER ROOM LAYOUT

CAPITAL COST ESTIMATE CASE: 1

Location: St. Mary's School
St. Mary's Harbour

Floor Area of Building	6,000 ft2	558 m2
Boiler Size	700,000 BTUH	205 kW
Heat Storage Tank Size	9,000 us gal	34065 litres
Additional Building Area Required	1,018 ft2	95 m2

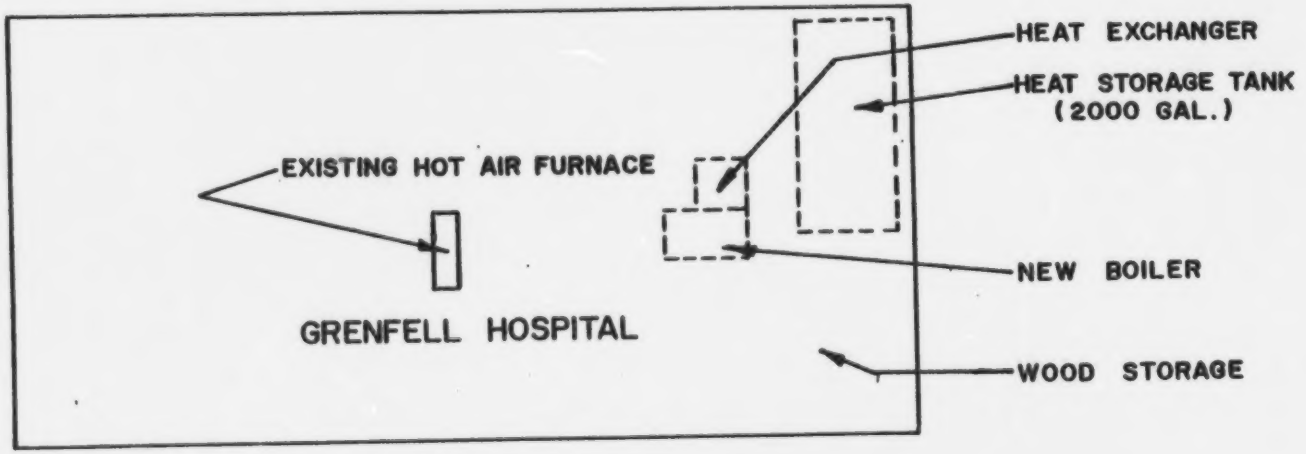
Boiler		$11,885
Heat Exchanger		N/A
Heat Storage Tank		$11,600
Building Extension	(1018*$30)	$30,540
Building Improvements		$500
Chimney		$1,600
	Subtotal	$56,125
Installation and Misc. 10%		$5,613
Contingency 15%		$9,261
Total Installed Capital Cost		$70,998

CAPITAL COST ESTIMATE CASE: 2

Location: St. Mary's School
St. Mary's Harbour

Floor Area of Building	6,000 ft2	558 m2
Boiler Size	480,000 BTUH	141 kW
Heat Storage Tank Size	6,000 us gal	22710 litres
Additional Building Area Required	818 ft2	76 m2

Boiler		$10,055
Heat Exchanger		N/A
Heat Storage Tank		$8,400
Building Extension	(818*$30)	$24,540
Building Improvements		$500
Chimney		$1,500
	Subtotal	$45,095
Installation and Misc. 10%		$4,510
Contingency 15%		$7,441
Total Installed Capital Cost		$57,045



NOTE: FURNACE LOCATED IN BASEMENT

GRENFELL HOSPITAL CHARLOTTETOWN
BOILER ROOM LAYOUT

ACRES

CAPITAL COST ESTIMATE CASE: 1

Location: Grenfell Hospital
Charlottetown

Floor Area of Building	2,900 ft2	270 m2
Boiler Size	350,000 BTUH	103 kW
Heat Storage Tank Size	3,000 us gal	11355 litres
Additional Building Area Required	0 ft2	0 m2

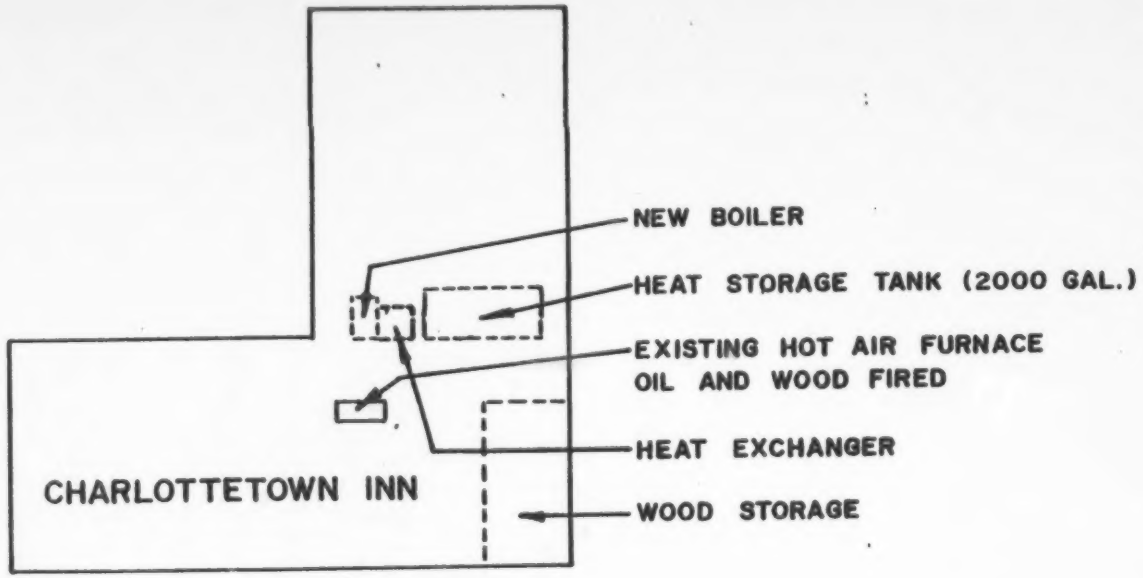
Boiler	$6,730
Heat Exchanger	$1,800
Heat Storage Tank	$4,700
Building Extension (0*$30)	N/A
Building Improvements	$2,000
Chimney	N/A
Subtotal	$15,230
Installation and Misc. 10%	$1,523
Contingency 15%	$2,513
Total Installed Capital Cost	$19,266

CAPITAL COST ESTIMATE CASE: 2

Location: Grenfell Hospital
Charlottetown

Floor Area of Building	2,900 ft2	270 m2
Boiler Size	130,000 BTUH	38 kW
Heat Storage Tank Size	2,000 us gal	7570 litres
Additional Building Area Required	0 ft2	0 m2

Boiler		$4,810
Heat Exchanger		$1,800
Heat Storage Tank		$3,800
Building Extension	(0*$30)	N/A
Building Improvements		$2,000
Chimney		N/A
	Subtotal	$12,410
Installation and Misc. 10%		$1,241
Contingency 15%		$2,048
Total Installed Capital Cost		$15,699



NOTE: FURNACE LOCATED IN BASEMENT

CHARLOTTETOWN INN , CHARLOTTETOWN
BOILER ROOM LAYOUT

CAPITAL COST ESTIMATE CASE: 1

Location: Charlottetown Inn
Charlottetown

Floor Area of Building	3,144 ft2	292 m2
Boiler Size	350,000 BTUH	103 kW
Heat Storage Tank Size	2,000 us gal	7570 litres
Additional Building Area Required	0 ft2	0 m2

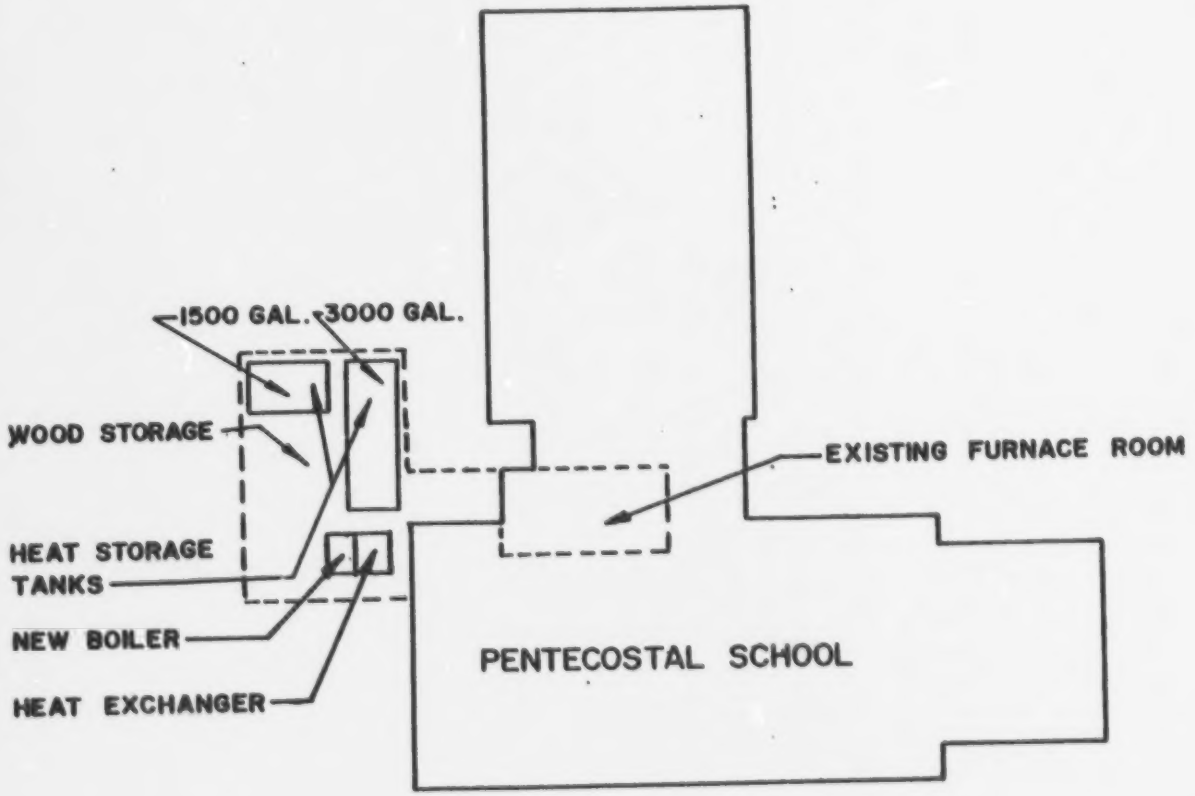
Boiler	$6,730
Heat Exchanger	$1,800
Heat Storage Tank	$3,800
Building Extension (0*$30)	N/A
Building Improvements	$2,000
Chimney	N/A
Subtotal	$14,330
Installation and Misc. 10%	$1,433
Contingency 15%	$2,364
Total Installed Capital Cost	$18,127

CAPITAL COST ESTIMATE CASE: 2

Location: Charlottetown Inn
Charlottetown

Floor Area of Building	3,144 ft2	292 m2
Boiler Size	130,000 BTUH	38 kW
Heat Storage Tank Size	2,000 us gal	7570 litres
Additional Building Area Required	0 ft2	0 m2

Boiler		$4,810
Heat Exchanger		$1,800
Heat Storage Tank		$3,800
Building Extension	(0*$30)	N/A
Building Improvements		$2,000
Chimney		N/A
	Subtotal	$12,410
Installation and Misc. 10%		$1,241
Contingency 15%		$2,048
Total Installed Capital Cost		$15,699



NOTE TWO HOT AIR FURNACES LOCATED ON MAIN FLOOR, ONE HOT AIR FURNACE LOCATED IN BASEMENT (crawl space).

PENTECOSTAL SCHOOL, CHARLOTTETOWN
BOILER ROOM LAYOUT

ACRES

CAPITAL COST ESTIMATE CASE: 1

Location: Pentecostal School
Charlottetown

Floor Area of Building	8,300 ft2	772 m2
Boiler Size	480,000 BTUH	141 kW
Heat Storage Tank Size	6,500 us gal	24603 litres
Additional Building Area Required	806 ft2	75 m2

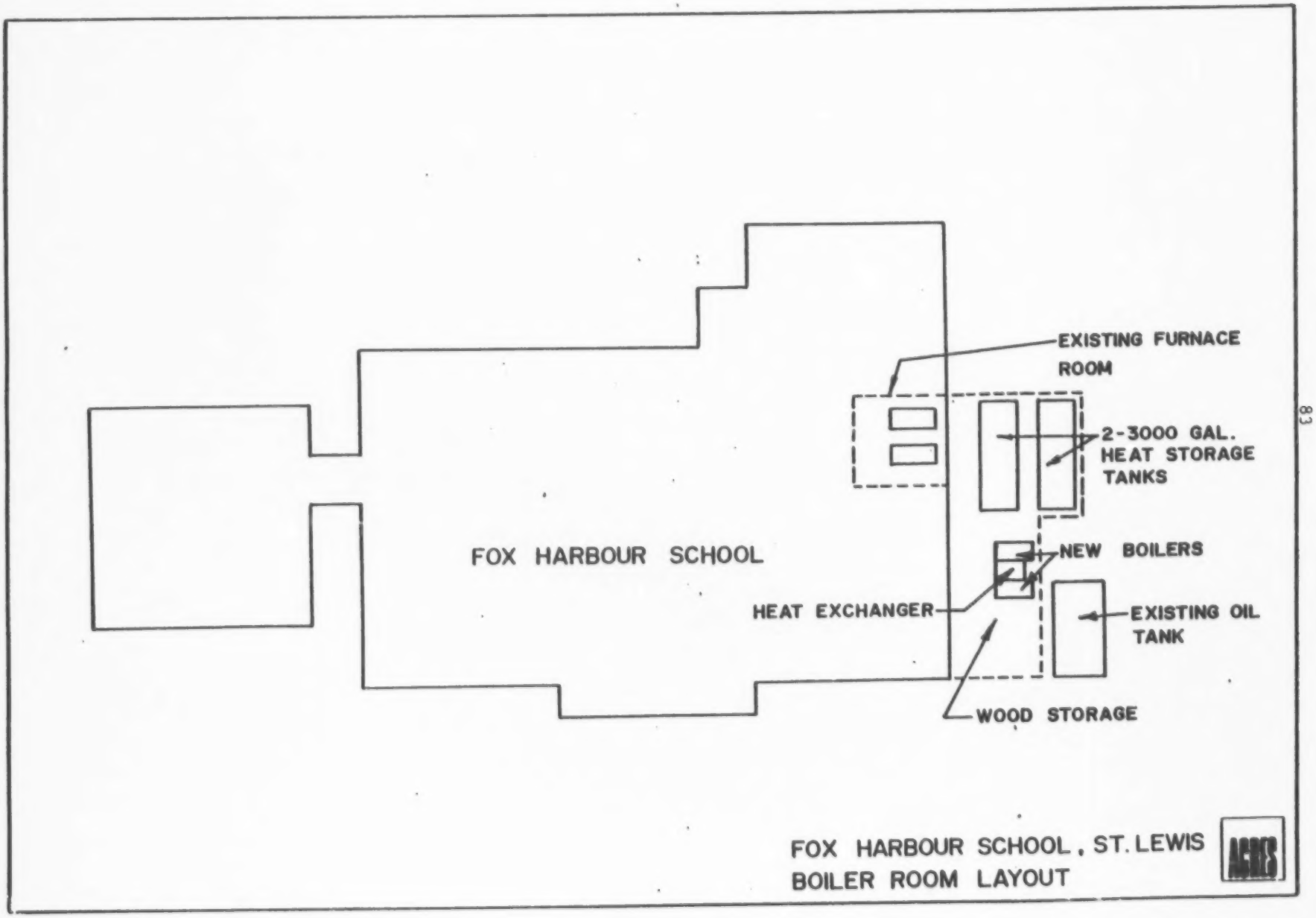
Boiler	$10,055
Heat Exchanger	$1,800
Heat Storage Tank	$7,600
Building Extension (806*$30)	$24,180
Building Improvements	$300
Chimney	$1,500
Subtotal	$45,735
Installation and Misc. 10%	$4,574
Contingency 15%	$7,546
Total Installed Capital Cost	$57,855

CAPITAL COST ESTIMATE CASE: 2

Location: Pentecostal School
Charlettotown

Floor Area of Building	8,300 ft2	772 m2
Boiler Size	350,000 BTUH	103 kW
Heat Storage Tank Size	4,500 us gal	17033 litres
Additional Building Area Required	573 ft2	53 m2

Boiler		$6,730
Heat Exchanger		$1,800
Heat Storage Tank		$7,400
Building Extension	(573*$30)	$17,190
Building Improvements		$500
Chimney		$1,600
	Subtotal	$35,220
Installation and Misc. 10%		$3,522
Contingency 15%		$5,811
Total Installed Capital Cost		$44,553



FOX HARBOUR SCHOOL, ST. LEWIS
BOILER ROOM LAYOUT

ACRES

CAPITAL COST ESTIMATE CASE: 1

Location: St. Lewis Allgrade
St. Lewis

Floor Area of Building	5,700 ft2	530 m2
Boiler Size	700,000 BTUH	205 kW
Heat Storage Tank Size	9,000 us gal	34065 litres
Additional Building Area Required	1,049 ft2	98 m2

Boiler		$12,460
Heat Exchanger		$1,800
Heat Storage Tank		$11,600
Building Extension	(1049*$30)	$31,470
Building Improvements		$500
Chimney		$1,600
	Subtotal	$59,430
Installation and Misc. 10%		$5,943
Contingency 15%		$9,806
Total Installed Capital Cost		$75,179

CAPITAL COST ESTIMATE CASE: 2

Location: St. Lewis Allgrade
St. Lewis

Floor Area of Building	5,700 ft2	530 m2
Boiler Size	480,000 BTUH	141 kW
Heat Storage Tank Size	6,000 us gal	22710 litres
Additional Building Area Required	849 ft2	79 m2

Boiler	$10,055
Heat Exchanger	$1,800
Heat Storage Tank	$2,400
Building Extension (849*$30)	$25,470
Building Improvements	$500
Chimney	$1,600
Subtotal	$47,825
Installation and Misc. 10%	$4,783
Contingency 15%	$7,891
Total Installed Capital Cost	$60,499

APPENDIX 2: Boiler Size Calculations

HIGHLANDS CONTRACTING LIMITED/ACRES - WOOD FUEL STUDY
CASE 1: LARGER UNITS, MINIMUM BACKUP OIL
SCEN A: DANIELS HARBOUR TEMPERATURE

COST

	ANNUAL OIL USE (LITRES)	ADD L BLDG. AREA REQUIRED (ft2)	COST @$30/FT2	ANNUAL OIL USE (GAL.)	FAHR. DEG. DAYS	HEAT LOSS (-10 deg. F) DAILY (MBTU)	HEAT LOSS (-10 deg. F) HOURLY (MBTU)	BOILER SIZE	# of burners	REQUIRE STORAGE (GAL.)	CORDS REQUIRED FOR WOOD ONLY	WOOD COST $/cord	FLOOR AREA (ft2)	CHIMNEY COST	HOURS BETWEEN FIRINGS at +14 Deg F (for 334 MBTU's per load. Temp. 14.-22. F)
Pentecostal School Port Hope Simpson	37020	1300	$38,998	9781	9935	7753	323	130 2 x 350	3	10500	54.2	$50.00	13000	$1,600	16.9
Bayview Integrated Port Hope Simpson	22950	819	$24,578	6063	9935	4806	200	130 350	2	6500	34.9	$50.00	4830	$1,600	15.9
Grenfell Hospital Port Hope Simpson	20390	799	$23,956	5387	11340	3741	156	130 350	2	6500	31.0	$50.00	3284	$0	20.5
St. Mary's School Mary's Harbour	26940	1018	$30,540	7118	9935	5642	235	350 350	2	9000	40.9	$100.00	6000	$1,600	18.5
Grenfell Hospital Charlottetown	10000	0	$2,000	2642	11340	1825	76	350	1	3000	15.2	$50.00	2000	$0	19.2
Charlottetown Inn Charlottetown	8000	0	$2,000	2114	11340	1468	61	350	1	3000	12.2	$50.00	2144	$0	18.1
Pentecostal School Charlottetown	21340	800	$24,157	5638	9935	4469	186	130 350	2	6500	32.4	$50.00	4200	$1,600	17.1
St. Lewis Allgrace St. Lewis	30710	1049	$31,465	8114	9935	6431	268	350 350	2	9000	46.7	$100.00	5700	$1,600	16.5

COAST

	OIL COST $/YR (100% OIL) @ $0.389 PER LITRE	WOOD COST $/YR (100% WOOD)	BURNING UNIT ($)	STORAGE UNIT ($)	BUILDING + CHIMNEY ($)	TOTAL CAPITAL COST ($)	INSTALLATION AND MISC. 10 %	CONTINGENCY 15 %	TOTAL INSTALLED CAPITAL COST	OIL BURNED (LITRES)	EQUIV. CORDS	CORDS REQUIRE	OIL COST @ $0.389 PER LITRE	WOOD COST	TOTAL FUEL COST	SAVINGS	Simple Payback (Years)
Pentecostal School Port Hope Simpson	$14,401	$2,812	$15,695	$12,700	$41,098	$69,495	$6,949	$11,466	$87,909	794	1.2	55.0	$309	$2,752	$3,061	$11,340	7.8
Bayview Integrated Port Hope Simpson	$8,928	$1,743	$11,855	$8,600	$26,078	$47,133	$4,713	$7,777	$59,624	595	0.9	34.0	$231	$1,698	$1,930	$6,998	8.5
Grenfell Hospital Port Hope Simpson	$7,932	$1,549	$10,055	$8,600	$24,455	$43,111	$4,311	$7,111	$54,536	76	0.1	30.9	$30	$1,543	$1,573	$6,359	8.6
St. Mary's School Mary's Harbour	$10,480	$4,093	$11,985	$11,600	$32,545	$58,173	$5,813	$9,262	$73,009	163	0.2	40.7	$64	$4,068	$4,131	$6,348	11.2
Grenfell Hospital Charlottetown	$3,890	$760	$8,530	$4,700	$2,000	$15,230	$1,523	$2,513	$19,266	0	0.0	15.2	$0	$760	$760	$3,130	6.2
Charlottetown Inn Charlottetown	$3,112	$608	$8,530	$3,900	$2,000	$14,330	$1,433	$2,364	$18,127	0	0.0	12.2	$0	$608	$608	$2,504	7.2
Pentecostal School Charlottetown	$8,701	$1,621	$11,855	$7,600	$26,237	$45,742	$4,574	$7,547	$57,864	447	0.7	31.7	$174	$1,587	$1,761	$6,940	8.8
St. Lewis Allgrade St. Lewis	$11,946	$4,665	$13,260	$11,600	$33,565	$58,435	$5,842	$9,640	$73,907	585	0.9	45.8	$228	$4,577	$4,804	$7,142	10.3

HIGHLANDS CONTRACTING LIMITED/ACRES - WOOD FUEL STUDY
CASE 1: LARGER UNITS, MINIMUM BACKUP OIL
SCEN B: DANIELS HARBOUR TEMPERATURE LESS 10 F

C.AST

	ANNUAL OIL USE (LITRES)	ADD'L BLDG. AREA REQUIRED (ft2)	COST @$30/FT2	ANNUAL OIL USE (GAL.)	FAHR. DEG. DAYS	HEAT LOSS (-10 deg. F) DAILY (MBTU)	HEAT LOSS (-10 deg. F) HOURLY (MBTU)	BOILER SIZE	# of burners	REQUIRE STORAGE (GAL.)	CORDS REQUIRED FOR WOOD ONLY	WOOD COST $/cord	FLOOR AREA (ft2)	CHIMNEY COST	HOURS BETWEEN FIRINGS at +14 Deg F (for 334 MBTU's per 1000 gals. Temp. 180-220 F)
Pentecostal School Port Hope Simpson	37020	1200	$36,998	9781	9935	7753	323	130 2 x 350	3	13500	56.2	$50.00	13000	$1,600	16.0
Bayview Integrated Port Hope Simpson	22950	819	$24,578	6063	9935	4806	200	130 350	2	6500	34.9	$50.00	4980	$1,600	15.9
Grenfell Hospital Port Hope Simpson	20390	799	$23,958	5387	11340	3741	156	130 350	2	6500	31.0	$50.00	3284	$0	20.5
St. Mary's School Mary's Harbour	26540	1018	$30,549	7118	9935	5642	235	350 350	2	9000	40.9	$100.00	6000	$1,600	18.8
Grenfell Hospital Charlottetown	10000	0	$2,000	2642	11340	1835	76	350	1	3000	15.2	$50.00	2400	$0	19.3
Charlottetown Inc Charlottetown	8000	0	$2,000	2114	11340	1468	61	350	1	3000	12.2	$50.00	3144	$0	16.1
Pentecostal School Charlottetown	21340	806	$24,197	5638	9935	4469	186	130 350	2	6500	32.4	$50.00	8300	$1,600	17.1
St. Lewis Allgrade St. Lewis	30710	1049	$31,465	8114	9935	6431	268	350 350	2	9000	46.7	$100.00	5700	$1,600	16.9

COAST

	OIL COST $/YR (100% OIL) @ $0.389 PER LITRE	WOOD COST $/YR (100% WOOD)	BURNING UNIT ($)	STORAGE UNIT ($)	BUILDING + CHIMNEY ($)	TOTAL CAPITAL COST ($)	INSTALLATION AND MISC. 10 %	CONTINGENCY 15 %	TOTAL INSTALLED CAPITAL COST	OIL BURNED (LITRES)	EQUIV. CORDS	CORDS REQUIRE	OIL COST @ $0.389 PER LITRE	WOOD COST	TOTAL FUEL COST	SAVINGS	Simple Payback (Years)
Pentecostal School Port Hope Simpson	$14,401	$2,812	$15,695	$12,700	$41,098	$69,493	$6,949	$11,466	$87,909	2551	3.9	52.4	$992	$2,619	$3,611	$10,79[illegible]	8.1
Bayview Integrated Port Hope Simpson	$8,928	$1,743	$11,055	$8,600	$26,678	$47,133	$4,713	$7,777	$59,624	1832	2.8	32.1	$713	$1,604	$2,317	$6,61[illegible]	9.0
Grenfell Hospital Port Hope Simpson	$7,932	$1,54[illegible]	$10,055	$8,600	$24,456	$43,111	$4,311	$7,113	$54,536	371	0.6	30.4	$144	$1,521	$1,665	$6,267	8.7
St. Mary's School Mary's Harbour	$10,480	$4,[illegible]	$11,885	$11,600	$32,648	$56,133	$5,613	$9,262	$71,008	732	1.1	39.8	$285	$3,982	$4,266	$6,21[illegible]	11.4
Grenfell Hospital Charlottetown	$3,890	$760	$8,52[illegible]	$4,700	$2,000	$15,230	$1,523	$2,513	$19,266	0	0.0	15.2	$0	$760	$760	$3,13[illegible]	6.2
Charlottetown Inn Charlottetown	$3,1[illegible]2	$608	$8,520	$3,800	$2,[illegible]00	$14,330	$1,433	$2,364	$18,127	0	0.0	12.2	$0	$608	$608	$2,50[illegible]	7.2
Pentecostal School Charlottetown	$8,301	$1,621	$11,055	$7,[illegible]00	$26,287	$45,742	$4,574	$7,547	$57,864	1445	2.2	30.2	$562	$1,511	$2,[illegible]74	$6,22[illegible]	9.3
St. Lewis Allgrade St. Lewis	$11,94[illegible]	$4,665	$13,260	$11,60[illegible]	$37,[illegible]65	$58,[illegible]25	$5,842	$9,[illegible]40	$77,907	1934	2.9	43.7	$752	$4,372	$5,125	$6,82[illegible]	10.8

HIGHLANDS CONTRACTING LIMITED/ACRES - WOOD FUEL STUDY
CASE 2: SMALLER UNITS, MORE BACKUP OIL
SCEN A: DANIELS HARBOUR TEMPERATURE

COAST

	ANNUAL OIL USE (LITRES)	ADD'L B.DG. AREA REQUIRED (ft2)	COST $830/ft2	ANNUAL OIL USE (GAL.)	FAHR. DEG. DAYS	HEAT LOSS (-20 deg. F) DAILY (MBTU)	HEAT LOSS (-20 deg. F) HOURLY (MBTU)	BOILER SIZE	# of burners	REQUIRE STORAGE (GAL.)	CORDS REQUIRED FOR WOOD ONLY	WOOD COST $/cord	FLOOR AREA (ft2)	CHIMNEY COST	HOURS BETWEEN FIRINGS at +14 Deg F (for 324 MBTU's per 1000 gals.) WITHOUT OIL
Pentecostal School Port Hope Simpson	37020	1119	$32,998	9781	9935	9786	366	2 x 350	2	9000	56.2	$50.00	13000	$1,600	13.7
Bayview Integrated Port Hope Simpson	22950	586	$17,578	6063	9935	5447	227	350	1	4500	34.9	$50.00	4880	$1,600	11.0
Grenfell Hospital Port Hope Simpson	20390	565	$16,995	5387	11249	4246	177	350	1	4500	33.0	$50.00	3284	$0	14.2
St. Mary's School Mary's Harbour	26940	818	$24,540	7118	9935	6294	266	350 x 175	2	9000	48.9	$100.00	6500	$1,600	12.5
Grenfell Hospital Charlottetown	10000	0	$2,000	2642	11340	2079	87	130	1	2000	15.2	$50.00	2900	$0	12.9
Charlottetown Inn Charlottetown	8000	0	$2,000	2114	11340	1662	69	130	1	2000	12.2	$50.00	2144	$0	16.1
Pentecostal School Charlottetown	21340	575	$17,187	5638	9935	5065	211	350	1	4500	32.4	$50.00	8360	$1,600	11.9
St. Lewis Allgrade St. Lewis	30710	849	$25,465	8114	9935	7289	304	350 x 175	2	9000	46.7	$100.00	5760	$1,600	11.0

COAST

	Oil Cost $/YR (100% Oil) @ $0.369 PER LITRE	Wood Cost $/YR (100% Wood)	Burning Unit ($)	Storage Unit ($)	Building + Chimney ($)	Total Capital Cost ($)	Installation and Misc. 10 %	Contingency 15 %	Total Installed Capital Cost	Oil Burned (Litres)	Equiv. Cords	Cords Require	Oil Cost @ $0.369 per Litre	Wood Cost	Total Fuel Cost	Savings	Simple Payback (Years)
Pentecostal School Port Hope Simpson	$14,401	$2,612	$12,460	$11,600	$35,698	$59,158	$5,916	$9,761	$74,835	2080	3.2	53.1	$0.[illegible]	$2,654	$3,463	$10,937	6.8
Bayview Integrated Port Hope Simpson	$8,928	$1,743	$8,530	$7,400	$19,678	$35,608	$3,561	$5,875	$45,045	2987	4.5	30.3	$1,1[illegible]	$1,517	$2,679	$6,249	7.2
Grenfell Hospital Port Hope Simpson	$7,932	$1,549	$6,730	$7,400	$17,458	$31,596	$3,159	$5,212	$39,956	844	1.3	29.7	$329	$1,485	$1,813	$6,[illegible]	6.5
St. Mary's School Mary's Harbour	$10,480	$4,093	$10,055	$8,400	$26,648	$45,103	$4,510	$7,442	$57,056	1958	3.0	37.9	$766	$3,794	$4,560	$5,9[illegible]	9.6
Grenfell Hospital Charlottetown	$3,890	$760	$6,610	$3,800	$2,000	$12,410	$1,241	$2,048	$15,699	1247	1.9	13.3	$485	$665	$1,150	$2,740	5.7
Charlottetown Inn Charlottetown	$3,112	$602	$6,610	$3,800	$2,000	$12,410	$1,241	$2,046	$15,697	430	0.7	11.5	$[illegible]	$575	$742	$2,[illegible]	6.6
Pentecostal School Charlottetown	$6,301	$1,621	$6,[illegible]	$7,400	$19,287	$35,217	$3,522	$5,811	$44,550	2158	3.3	29.1	$[illegible]	$1,457	$2,297	$6,[illegible]	7.4
St. Louis Allgrade St. Louis	$11,946	$4,665	$11,[illegible]	$8,4[illegible]	$27,565	$47,[illegible]	$4,781	$7,[illegible]	$[illegible],492	[illegible]81	5.6	41.1	$1,4[illegible]	$4,198	$5,540	$6,[illegible]	9.4

HIGHLANDS CONTRACTING LIMITED/ACRES - WOOD FUEL STUDY
CASE 2: SMALLER UNITS, MORE BACKUP OIL
SCEN B: DANIELS HARBOUR TEMPERATURE LESS 10 F

EX-ST

	ANNUAL OIL USE (LITRES)	ADD'L BLDG. AREA REQUIRED (ft2)	COST $930/FT2	ANNUAL OIL USE (GAL.)	FARM. DEG. DAYS	HEAT LOSS (-20 deg. F) DAILY (MBTU)	HEAT LOSS (-20 deg. F) HOURLY (MBTU)	BOILER SIZE	# of burners	REQUIRE STORAGE (GAL.)	CORDS REQUIRED FOR WOOD ONLY	WOOD COST $/cord	FLOOR AREA (ft2)	CHIMNEY COST	HOURS BETWEEN FIRINGS at +14 Deg F (for 334 MBTU s per 1000 gals.) WITHOUT OIL
Pentecostal School Port Hope Simpson	37020	1100	$32,998	9781	9935	8786	366	2 x 350	2	9000	56.2	$50.00	13000	$1,600	13.7
Bayview Integrated Port Hope Simpson	22950	586	$17,578	6063	9935	5447	227	350	1	4500	34.9	$50.00	4880	$1,600	11.9
Grenfell Hospital Port Hope Simpson	20390	565	$16,956	5387	11340	4240	177	350	1	4500	31.0	$50.00	3284	$0	14.2
St. Mary's School Mary's Harbour	26540	819	$24,048	7118	9935	6394	266	350 130	2	6000	40.9	$100.00	6000	$1,600	12.5
Grenfell Hospital Charlottetown	10000	0	$2,000	2642	11340	2079	87	130	1	2000	15.2	$50.00	2000	$0	12.9
Charlottetown Inn Charlottetown	8000	0	$2,000	2114	11340	1663	69	130	1	2000	12.2	$50.00	2144	$0	16.1
Pentecostal School Charlottetown	21340	573	$17,197	5636	9935	5065	211	350	1	4500	33.4	$50.00	8300	$1,600	11.9
St. Lewis Allgrade St. Lewis	30710	849	$25,465	8114	9935	7289	304	350 130	2	6000	46.7	$100.00	5700	$1,600	11.0

COAST

	OIL COST $/YR (1992 OIL @ $0.389 PER LITRE	WOOD COST $/YR (100% WOOD)	BURNING UNIT ($)	STORAGE UNIT ($)	BUILDING + CHIMNEY ($)	TOTAL CAPITAL COST ($)	INSTALLATION AND MISC. 10 %	CONTINGENCY 15 %	TOTAL INSTALLED CAPITAL COST	OIL BURNED (LITRES)	EQUIV. CORDS	CORDS REQUIRE	OIL COST @ $0.389 PER LITRE	WOOD COST	TOTAL FUEL COST	SAVINGS	Simple Payback (Years)
Pentecostal School Port Hope Simpson	$14,461	$2,912	$12,460	$11,600	$25,098	$59,150	$5,916	$9,761	$74,835	5801	8.5	47.8	$2,179	$2,398	$4,566	$9,894	7.6
Bayview Integrated Port Hope Simpson	$8,928	$1,743	$9,530	$7,400	$19,678	$35,608	$3,561	$5,875	$45,045	7088	10.7	24.1	$2,757	$1,206	$3,963	$4,964	9.1
Grenfell Hospital Port Hope Simpson	$7,932	$1,549	$6,730	$7,400	$17,456	$31,586	$3,159	$5,212	$39,956	2330	3.5	27.4	$906	$1,372	$2,279	$5,653	7.1
St. Mary's School Mary's Harbour	$10,480	$4,092	$10,055	$8,400	$26,648	$45,103	$4,510	$7,442	$57,056	5129	7.8	33.2	$1,995	$3,315	$5,311	$5,169	11.0
Grenfell Hospital Charlottetown	$3,890	$769	$6,610	$3,800	$2,000	$12,410	$1,241	$2,048	$15,699	2097	4.4	10.8	$1,527	$540	$1,667	$2,223	7.1
Charlottetown Inn Charlottetown	$3,112	$608	$6,610	$3,800	$2,000	$12,410	$1,241	$2,048	$15,699	1145	1.7	10.4	$445	$521	$966	$2,146	7.3
Pentecostal School Charlottetown	$8,201	$1,621	$9,530	$7,400	$19,287	$35,217	$3,522	$5,811	$44,550	5375	8.1	24.2	$2,091	$1,214	$3,305	$4,896	8.9
St. Lewis Allgrade St. Lewis	$11,946	$4,065	$11,655	$8,400	$27,565	$47,620	$4,762	$7,857	$60,239	9889	12.5	33.2	$3,458	$3,319	$6,776	$5,171	11.7

02/19/85

HIGHLANDS CONTRACTING LIMITED - WOOD FUEL STUDY
GRENFELL HOSPITAL, PORT HOPE SIMPSON
CASE: 1A - DANIELS HARBOUR TEMPERATURES

NO OIL TEMPERATURE (F)	=	4
NO OIL HEAT LOSS (MBTU/HR)	=	128.00
DEGREE DAYS	=	11340
FUEL CONSUMPTION (US GALLONS)	=	5373

TEMP (FAR)	HEAT LOSS (MBTU/HR)	HOURS AT THAT TEMP. (7 YRS)	ADDITIONAL HEAT LOSS (MBTU)
4	126.45	190	0.00
3	128.52	156	11.61
2	130.59	133	49.28
1	132.67	106	70.67
0	134.74	98	94.35
-1	136.81	105	132.19
-2	138.89	88	136.85
-3	140.96	71	131.43
-4	143.03	43	92.33
-5	145.10	59	144.16
-6	147.18	38	104.10
-7	149.25	35	106.25
-8	151.32	29	96.62
-9	153.40	23	83.44
-10	155.47	29	113.80
-11	157.54	28	118.17
-12	159.61	32	144.52
-13	161.69	12	57.75
-14	163.76	12	61.30
-15	165.83	10	54.08
-16	167.91	2	11.40
-17	169.98	0	0.00
-18	172.05	0	0.00
-19	174.13	0	0.00
-20	176.20	1	6.89
TOTAL ADDITIONAL HEAT LOSS			1321.17

ADDITIONAL OIL REQUIRED (LITRES)	76.2
COST AT 38.9 CENTS/LITRE	$29.63

02/19/85

HIGHLANDS CONTRACTING LIMITED - WOOD FUEL STUDY
GRENFELL HOSPITAL, PORT HOPE SIMPSON
CASE: 1B - DANIELS HARBOUR TEMPERATURES LESS 10 F

NO OIL TEMPERATURE (F)	=	4
NO OIL HEAT LOSS (MBTU/HR)	=	128.00
DEGREE DAYS	=	11340
FUEL CONSUMPTION (US GALLONS)	=	5373

TEMP (FAR)	HEAT LOSS (MBTU/HR)	HOURS AT THAT TEMP. (7 YRS)	ADDITIONAL HEAT LOSS (MBTU)
4	126.45	466	0.00
3	128.52	357	26.56
2	130.59	387	143.40
1	132.67	378	252.00
0	134.74	379	364.90
-1	136.81	334	419.22
-2	138.89	280	435.42
-3	140.96	256	473.90
-4	143.03	220	489.59
-5	145.10	264	645.07
-6	147.18	190	520.52
-7	149.25	156	473.57
-8	151.32	133	443.14
-9	153.40	106	384.57
-10	155.47	98	384.56
-11	157.54	105	443.12
-12	159.61	98	397.44
-13	161.69	71	341.59
-14	163.76	43	219.67
-15	165.83	59	318.88
-16	167.91	38	216.53
-17	169.98	35	209.90
-18	172.05	29	182.50
-19	174.13	23	151.55
-20	176.20	29	199.68
-21	178.27	28	201.08
-22	180.34	32	239.29
-23	182.42	12	93.29
-24	184.49	12	96.84
-25	186.56	10	83.66
-26	188.64	2	17.32
-27	190.71	0	0.00
-28	192.78	0	0.00
-29	194.85	0	0.00
-30	196.93	1	9.85
TOTAL ADDITIONAL HEAT LOSS			8878.81

ADDITIONAL OIL REQUIRED (LITRES)	371.3
COST AT 38.9 CENTS/LITRE	$144.45

APPENDIX 3: Boiler Specifications

What is the new technology and why is Tempest™ different?

The NEW woodburning technology, refined and developed by Dumont Industries, is based on the original research and basic design by Prof. Richard C. Hill of the Univ. of Me. The energy crisis brought home the need to develop wood as a primary fuel with the convenience, safety and practical economics that oil, gas and electricity have provided in the past. Thoroughly tested and proven in hundreds of homes and businesses, the NEW technology provides the maximum return on your hard earned energy dollars.

The key to the TEMPEST™ System is the separation of the wood combustion process from the actual heat distribution, through the use of a water-filled heat storage tank. Wood is burned in a unique boiler, at very high temperatures in a very turbulent atmosphere. The sole function of the boiler is to heat water quickly, at peak combustion efficiency, burning even the dangerous creosote-forming gases — the cause of chimney fires. The heat storage tank holds the heat produced by the boiler until it is needed.

This new technology is not to be confused with the inefficiency, inconvenience, and safety problems of traditional "airtight" stoves, furnaces or boilers. The "airtight" attempts to match the heat of the fire to the heat requirement of the home by regulating the air supply or draft. This results in the incomplete combustion of a smoldering fire, wasting energy dollars up the chimney as unburned gases or depositing them as dangerous creosote.

TEMPEST™ virtually eliminates all the problems that have plagued the airtight method and brings wood to the forefront as a practical, economical and safe primary fuel.

Actual installation of TEMPEST™ 130 with the OPTIONAL OIL BURNER for system back-up. (Heat storage tank not shown).

- **Safety First**

  All of the creosote-forming gases are burned, eliminating the cause of chimney fires.

- **Super Efficiency from Your Wood Pile**

  Airtight methods extract only about 50% of the heat from the wood; TEMPEST™ extracts up to 80%. Your wood dollars don't go up the chimney.

- **Convenience to Match Your Lifestyle**

  Having the heat storage tank to hold the heat allows you to fire when most convenient, matching your lifestyle and work schedule. TEMPEST™ offers you the freedom of conventional fuels.

- **Controlled Heat Delivery**

  If you don't need the heat, it stays in the heat storage tank. Heat is delivered from storage only when called for by the thermostat set to your comfort level.

- **Burn Green Wood**

  If you have ever tried to burn green wood in a conventional stove, you'll love TEMPEST™ - a labor saving design.

- **Pollution Free Woodburning**

  With TEMPEST™, the combustion is so complete that there is no visible wood-smoke after a few minutes of operation.

- **A Complete System**

  With provision for an optional oil burner, TEMPEST™ allows you to take an extended Winter Vacation!

- **Year-round Domestic Hot Water**

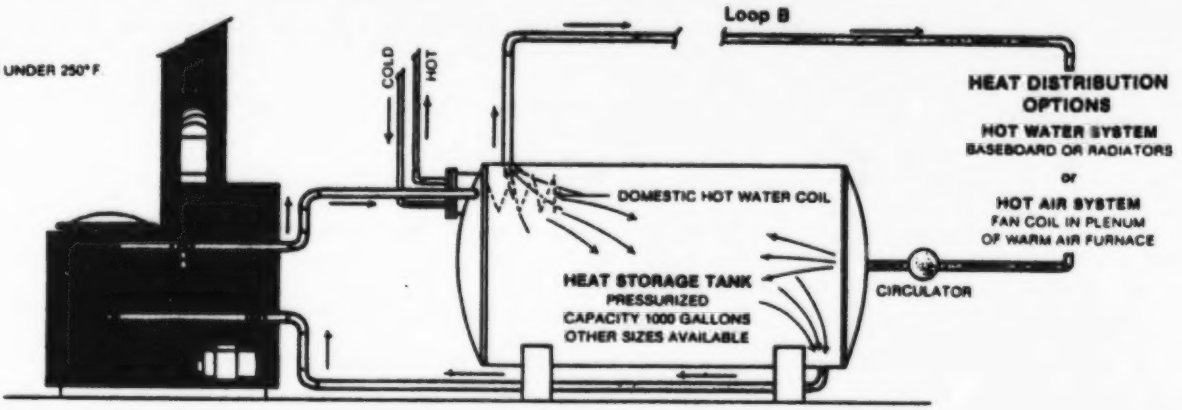
  A copper coil in the heat storage tank provides abundant hot water, year round, and at a fraction of the cost of heating it by conventional means.

The Tempest™ System

The TEMPEST™ system consists of three major components; the unique TEMPEST™ Boiler (described in detail below), the Heat Storage Tank, and the Heat Delivery System. Separate piping loops connect the boiler to the heat storage tank (LOOP A), and the storage tank to the Heat Delivery System (LOOP B). Heat delivery is by conventional baseboard or radiators, or a fan coil in the ductwork of a warm air system.

The sole purpose of the TEMPEST™ Boiler is to heat the water for the storage tank. The tank, which is insulated, holds the heat until it is needed by the heat delivery system.

Domestic Hot Water is provided by a finned-copper coil in the heat storage tank.

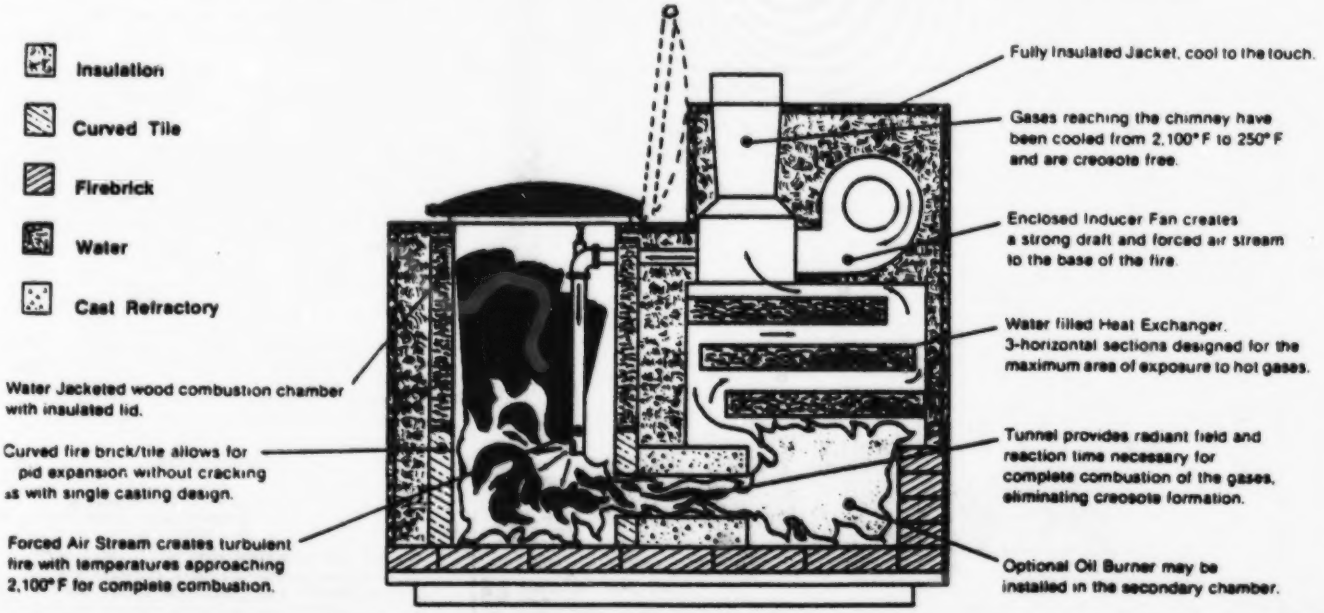


The Tempest™ Boiler

Wood is easily loaded and ignited in the vertical Wood Combustion Chamber. The large diameter and volume allows the loading of a substantial quantity of wood and long intervals between firings. In most cases, two or three firings a day will be sufficient.

The Inducer Fan force feeds air to the base of the fire through the Combustion Air Tube and at the same time produces a strong draft through the boiler to the chimney. This push-pull combination creates an intense, turbulent fire with temperatures approaching 2100°F. At these temperatures in the combustion chamber and tunnel, the wood is completely burned, including 100% of the creosote-forming gases.

From the Secondary Chamber, the very hot gases are drawn upward in a serpentine pattern through the horizontal sections of the heat exchanger. The Heat Exchanger transfers the heat to the water circulating from the Heat Storage Tank, cooling the gases from 2100° F. to 250° F. before they enter the chimney. A sensor automatically turns off the Inducer Fan when the wood has been burned up and the only residue is a small quantity of non-combustible wood ash.


Insulation
Curved Tile
Firebrick
Water
Cast Refractory
Water Jacketed wood combustion chamber with insulated lid.
Curved fire brick/tile allows for pid expansion without cracking as with single casting design.
Forced Air Stream creates turbulent fire with temperatures approaching 2,100° F for complete combustion.
Fully Insulated Jacket, cool to the touch.
Gases reaching the chimney have been cooled from 2,100° F to 250° F and are creosote free.
Enclosed Inducer Fan creates a strong draft and forced air stream to the base of the fire.
Water filled Heat Exchanger. 3-horizontal sections designed for the maximum area of exposure to hot gases.
Tunnel provides radiant field and reaction time necessary for complete combustion of the gases, eliminating creosote formation.
Optional Oil Burner may be installed in the secondary chamber.

Some frequently asked questions about TEMPEST.™

Q. What size TEMPEST™ System do I need?

A. The TEMPEST™ Boiler is available in two sizes: the TEMPEST™ 130 (130,000 BTU's per hour) and the TEMPEST™ 350 (350,000 BTU's per hour).

The goal with TEMPEST™ is to be able to fire the boiler only twice a day with sufficient heat storage to maintain comfort levels between firings.

The typical residential system is the TEMPEST™ 130 with a 1,000 gallon heat storage tank. Your local TEMPEST™ dealer can guide you in selecting a system that meets your requirements and provides a convenient firing schedule.

Q. How much space does a TEMPEST™ System require?

A. The TEMPEST™ Boiler takes about the same space as a conventional oil or gas boiler. The heat storage tank is available in a range of diameters and lengths to meet your requirements, for example, a 1,000 gallon tank with a diameter of five feet is only nine feet long.

Q. How do I get the storage tank into my basement?

A. The heat storage tanks are available fully assembled or in kit form. The pieces of the kit tank will fit through almost any doorway or stairwell and are easily assembled by the TEMPEST™ installer.

Q. Can I [illegible] the TEMPEST™ Boiler as an add-on to my present boiler?

A. In some cases the TEMPEST™ System can be combined with an existing boiler; however, it is always necessary to have the heat storage tank and to provide a separate flue for the TEMPEST™ Boiler.

Remember, TEMPEST™ is available with a built-in oil burner for backup, and when burning oil may be as efficient as a modern conventional boiler or furnace.

Q. What is a typical operating schedule with a TEMPEST™?

A. With proper sizing of the TEMPEST™ Boiler and storage tank, the typical operating schedule is two firings a day, one in the morning and one in the evening.

Each load of wood burns in about two or three hours, creosote-free. The heat is delivered to the heat storage tank and held there until needed.

For summertime domestic hot water, the typical schedule is two loads of wood per week. The large domestic water coil ensures an adequate supply of hot water.

Q. What about maintenance and cleaning?

A. Unlike conventional wood boilers and furnaces, there is no creosote with TEMPEST.™ Gone is expensive chimney cleaning! The only residue is a fine gray ash, easily removed after about every two to three cords of wood.

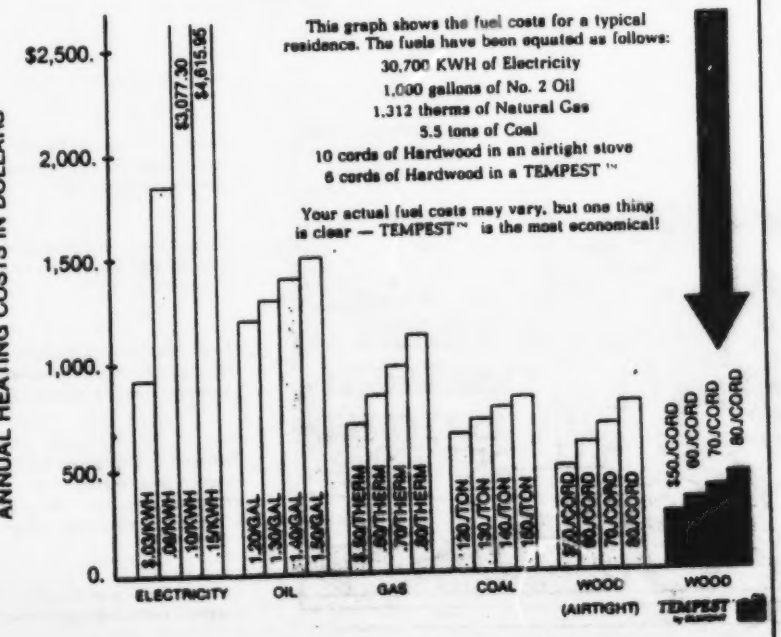
Q. Can green wood be burned in TEMPEST™?

A. Yes, and creosote-free; however the energy required to boil the water out of the wood will not be available to heat your house and domestic water. Dry wood provides more useable heat.

Q. Won't the heat storage tank make the basement hot, particularly in summertime domestic water heating?

A. No, the boiler and storage tank are insulated.

TEMPEST™ Is Economical



This graph shows the fuel costs for a typical residence. The fuels have been equated as follows:

30,700 KWH of Electricity
1,000 gallons of No. 2 Oil
1,312 therms of Natural Gas
5.5 tons of Coal
10 cords of Hardwood in an airtight stove
6 cords of Hardwood in a TEMPEST™

Your actual fuel costs may vary, but one thing is clear — TEMPEST™ is the most economical!

What Owners Are Saying:

"I've had a TEMPEST™ wood boiler for two years. I'll never have a chimney fire because the TEMPEST™ burns wood completely — no creosote, only a fine white ash."

Ed Pullen

—Ed Pullen, Fire Chief.
Oakland, Maine 1954-1979

"During the winter, I light my TEMPEST™ wood boiler every evening after work. In a few hours, the heat storage tank is full of piping hot water — ready to heat the entire house, plus all my domestic hot water, through the night and all the next day. TEMPEST™ has made wood heating convenient."

Ken Mair

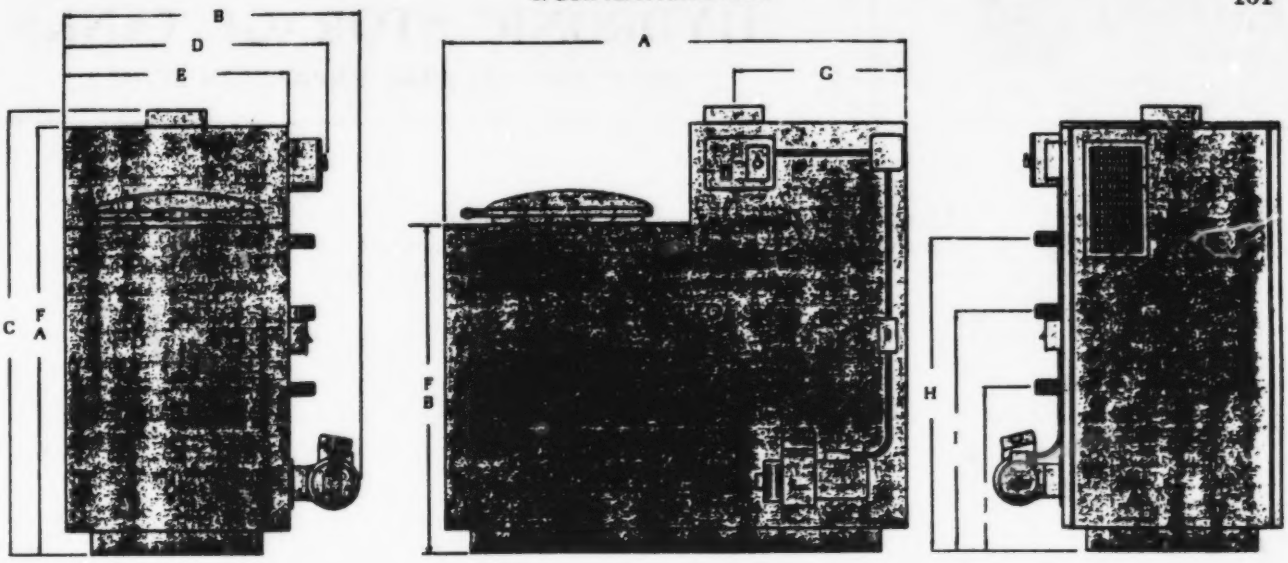
—Ken Mair,
Computer Specialist,
Auburn, Maine

"I heat half my 86,000 square foot nursing home and provide all the hot water for 171 patients with two of the larger TEMPEST™ wood boilers. It was the economics of the TEMPEST™ system that convinced me to go with wood heat. My up-front costs of conversion were paid off in the first year."

Bill Gillis

—Bill Gillis, Owner/Administrator,
Clover Manor Nursing Home, Auburn, Maine

Ask your Authorized TEMPEST™ Dealer for an economic analysis today, and learn how TEMPEST™ can change your energy future.



ITEM	TEMPEST 130	TEMPEST 350
A Overall length	60¾"	74¾"
B Overall width with oil burner	36 1/16"	41 9/16"
C Height to top of flue connector	53"	60¾"
D Width (oil burner removed)	32 13/16"	38 5/16"
E Width with oil burner control box and nipples removed	28½"	33½"
F (A) Height to top of cabinet	51 5/16"	57 9/16"
F (B) Height to top of cabinet "Loading Lid"	39 3/8"	43"
G Distance back panel to flue connector	25 3/8"	33¼"
INLET AND OUTLET NIPPLES, HEIGHT ABOVE FLOOR - (H, I & J)		
H Wood comb chamber outlet	37 5/8"	41"
I Heat exchanger outlet	31"	33 1/16"
J Wood comb chamber and heat exchanger inlet	21"	21 9/16"

SPECIFICATIONS:

Rated output	130,000 BTUH	350,000 BTUH
FUEL: wood in log or stick form		
Max operating pressure (water)	30 psi	30 psi
Supply and return nipples	1¼" SCH 40	1½" SCH 40
Flue connector collar	7"	10"
Min. flue size	8"x8" tile or 8" dia.	12"x12" tile or 10" dia.
Shipping weight	1200#	2100#
ELECTRICAL REQUIREMENT		
Wood	115 VAC., 6.2, Amps	115 VAC., 13.4 Amps or 230 VAC., 6.7 Amps
COMBUSTION CHAMBER		
Diameter	18½"	22½"
Depth	32"	35 1/8"
Max. practical wood length	28"	31"
Volume (assuming one layer of 24" logs)	3.68 ft.^{3}	5.75 ft.^{3}
Water jacket capacity	13.8 gals.	19 gals.
Heat transfer surface	8.2 ft.^{2}	15 ft.^{2}

Base construction: sectional curved tiles, 2800°F rating to prevent cracking due to expansion and contraction. Bottom bricks on resilient cushion to absorb wood loading impact.

HEAT EXCHANGER:		
Heat transfer surface	56 ft.^{2}	96 ft.^{2}
Water capacity	14.7 gals.	28.8 gals.
Construction	horizontal extended surface, 3 sections	
OPTIONAL OIL BURNER		
Beckett, model AF, flame retention		
Blast tube length	7¾"	7¾"
Max. recommended nozzle size, #2 oil	1 GPH	1½" GPH

APPROVALS

Listed by the Energy Testing Laboratory of Maine to ETLM 78-1 and CSA B-366-M-1979.
Approved by the Maine Oil and Solid Fuel Technicians Licensing Board, and the Connecticut Board of Materials Review.
(H) Constructed to the standards of the American Society of Mechanical Engineers (ASME) and National Board Registered.

Dumont Industries
P.O. Box 148
Monmouth, Maine
04259

"Our primary concern is excellence in workmanship and service."

Robert Bell Industries Limited
P.O. Box 70
156 Main St. S
Seaforth, Ont
N0K 1W0
Tel: 519-527-0600
Telex: 069-55305

TEMPEST by DUMONT
Dumont Industries, Monmouth, Maine 04259
(207) 933-4611

HYDRONIC STORAGE TANKS

30 PSI WP INTEGRAL EXPANSION SERIES

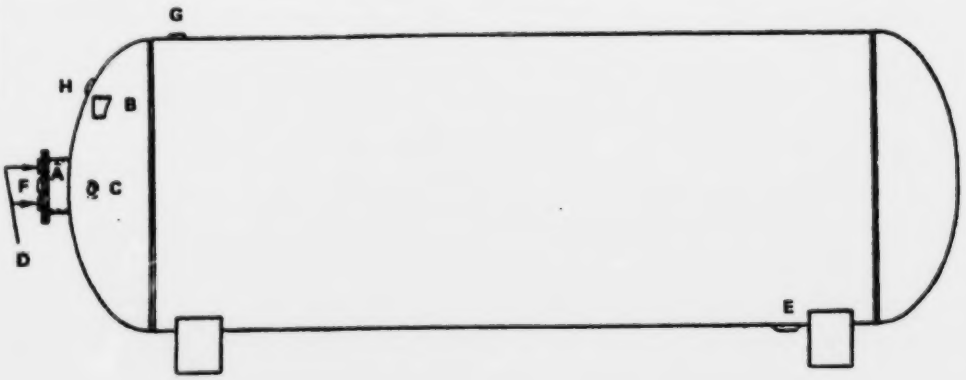
Designed and built by Dumont Industries, these tanks provide the optimum combination of volume, working pressure, operation and ease of installation. The Integral Expansion Series relies on a layer of air to accommodate volume changes due to temperature fluctuations, very much like standard compression tanks.

The tanks are available completely assembled or in kit form. The kit consists of two heads and an appropriate number of half circle mid-sections sized to fit through most doorways, and easily welded on site.

All tappings and domestic coil flanges are factory installed in both assembled and kit tanks.

	SIZ	
A	3/4	DOMESTIC HOT WATER COIL FLANGE
B	2	BOILER FEED
C	3/4	LOW LIMIT AQUASTAT
D	1	DOMESTIC HOT WATER
E	2	BOILER RETURN
F	1	THERMOMETER
G	1/2"	AIR FILL TAPPING
H	3/4	AIR PURGE TAPPING

SIZES ARE STANDARD NPT



SPECIFICATIONS

Gals.	Dia.	Length(oa)	Weight	Dia.	Length(oa)	Weight	Dia.	Length(oa)	Weight	Dia.	Length(oa)	Weight
1000	3'	24'	1226 lbs	4'	14'	1072 lbs	5'	9'	1014 lbs	6'	7'	1455 lbs
1500	3'	35'	1745 lbs	4'	20'	1449 lbs	5'	14'	1456 lbs	6'	10'	1889 lbs
2000	3'	47'	2310 lbs	4'	27'	1889 lbs	5'	18'	1809 lbs	6'	13'	2322 lbs
2500				4'	33'	2266 lbs	5'	22'	2163 lbs	6'	15'	2611 lbs
3000				4'	40'	2716 lbs	5'	26'	2516 lbs	6'	18'	3044 lbs
3500							5'	30'	2870 lbs	6'	21'	3477 lbs
Body HRS Heads	11 ga HRS. 3/16" Flanged & Dished			11 ga HRS 3/16" Flanged & Dished			10 ga HRS 3/16" Flanged & Dished			3/16 HRS 3/16" Flanged & Dished		

NOTES:

1. These tanks are suitable for up to 30 psi working pressure in applications not requiring the use of ASME Code tanks. ASME Code tanks are available; prices and specifications will be furnished on application.
2. When calculating the space required for tanks, allow for the fitting and removal of piping, domestic water coil, and insulation.
3. All specifications and prices are subject to change without notice.

NEW HEAT STORAGE TANK COMBINES EXPANSION & STORAGE

Developed by Dumont engineers, the new heat storage tank shown below is expected to reduce the costs of TEMPEST® installations, while increasing the amount of expansion capacity available.

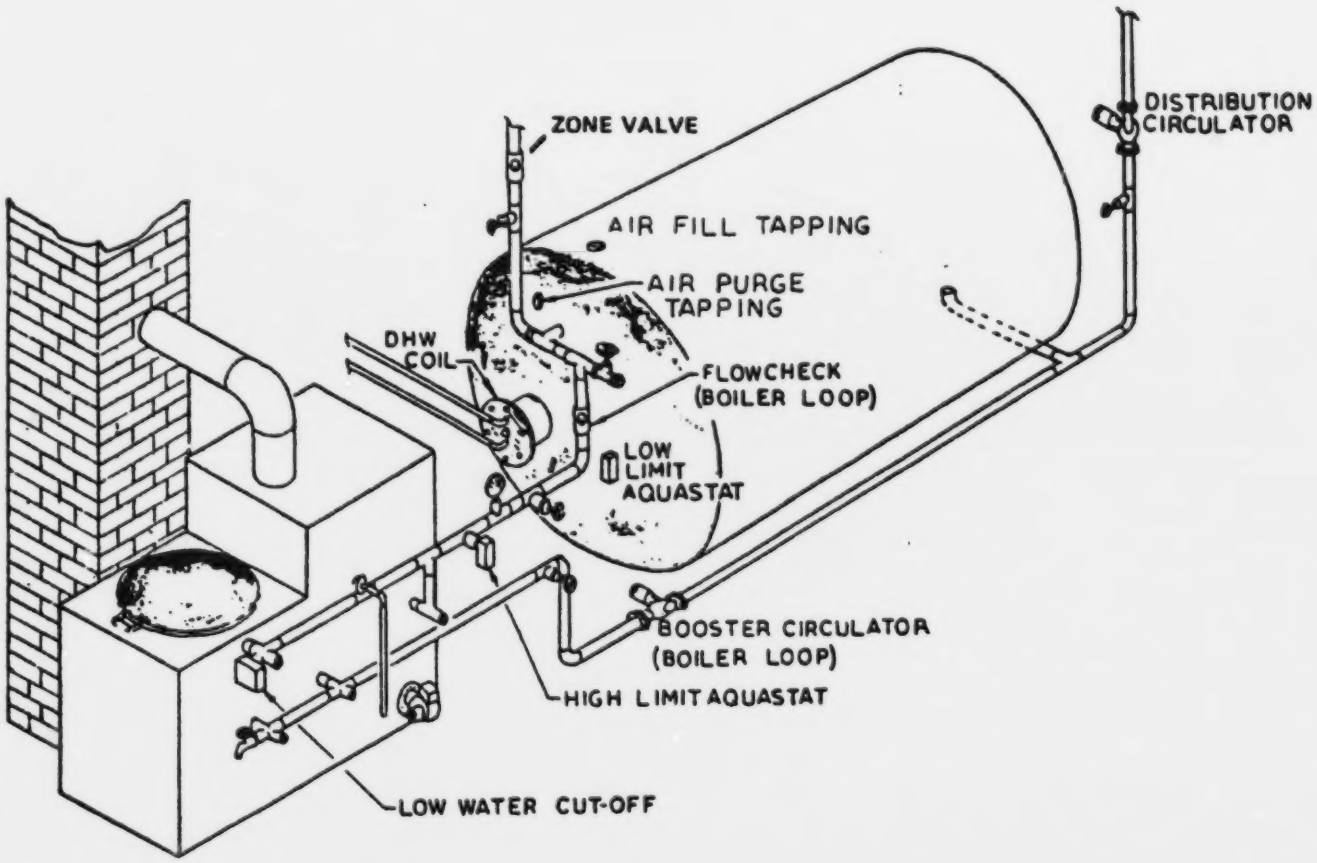
The new storage tank, called the integral expansion series, is very similar to the N_2 series storage tanks in that it relies on a layer of air to expand and contract as the volume of water changes with temperature fluctuations. Essentially the Integral Expansion Series is very much like compression tanks used in hydronic heating systems for years. Since air is 78% nitrogen, the air which is entrained in the systems soon converts to nitrogen and will not adversely affect the boiler or tank through corrosion. The original oxygen in the air is picked up by the inhibitrex solution and converts the free oxygen to oxides, and hence prevents corrosion from occurring indefinitely.

The new Integral Expansion Series tanks represent a substantial savings over the use of separate expansion. tanks, where for example, costs could well exceed $500 for a typical 1500 gal. system, including expansion tanks, valves, piping and labor.

System operation is also improved since the system can be operated immediately from a cold fill, unlike the modular tanks which had to be adjusted at operating temperature and pressure.

Integral Expansion Tanks are a little larger than conventional tanks to accommodate the additional volume required for air, but they are still rated at water capacities.

Other changes incorporated in the Integral Expansion tanks include: 1)Lowering the D-10 coil to the center of the tank head to insure that it is submerged in water; 2)Combining the boiler feed tapping and the distribution feed tapping, and 3)Combining the boiler return tapping and the distribution return tapping. The reason for the latter two changes is to provide for direct feed from the boiler to the distribution system in the event of low tank temperatures and a system demand for immediate heat.



CHARGING AND FILL PROCEDURE

1) Open all vents in the distribution system, and insure that precautions have been taken so that water will not discharge on a finished floor area.

2) All valves between the boiler tank and distribution systems should be opened at this time and water should be allowed to enter the system.

3) When all the air is bled from the system, the air vents should be adjusted and any air trapped in the loops should be freed by operating the boiler and distribution loop circulators. The system should be charged to 12 psi.

4) The system is now ready for operation.

COMPARISON CHART
for
JETSTREAM, MADAWASKA, and DUMONT WOOD BOILERS

FEATURE	JETSTREAM	MADAWASKA	DUMONT	COMMENT
RATED OUTPUT	120,000 BTU's/HR.	115,000 BTU's/HR.	130,000 BTU's/HR. and 350,000 BTU's/HR.	Dumont has a boiler to meet the full range of residential and light commercial heat and DHW requirements.
BACKUP OIL or GAS BURNER	NO	NO	YES	Dumont is a complete central heating and year-round DHW system With a Dumont, you can take a winter vacation!
WOOD CHAMBER				
Diameter	12 1/4 in.	14 in.	17 in. (DWB-130) 23 in. (DWB-350)	Diameter and Cross Sectional Area are very important in determining how much wood can be loaded.
Cross Sectional Area	118 sq. in.	154 sq. in.	227 sq. in. (DWB130) 415 sq. in. (DWB350)	Length (Depth) of the Wood Chambe is less important as most users will be burning 24 in logs.
Volume (assuming one layer of 24 in. logs)	1.64 cu. ft.	2.14 cu. ft.	3.15 cu. ft. (DWB130) 5.76 cu. ft. (DWB350)	300,000 BTU's per firing 700,000 BTU's per firing
HEAT EXCHANGER				
Type	Vertical Fire Tube	Vertical Fire Tube	Horizontal, extended surface, three section	The sectional heat exchanger i the most expansive to build, however, the tremendous area for heat transfer justifies it
Heat Transfer Surface (area)	19 sq. ft. (approx)	13 sq. ft. (approx)	49 sq. ft. (DWB-130) 96 sq. ft. (DWB-350)	
BASE CONSTRUCTION	Single Casting	Single Casting	Curved Sectional and Flat Firebrick, both hard and insulating as appropriate, with cast refractory tunnel	The use of sectional materials allows rotation and translation with temperature change, prevents cracking, and allows replacement of an individual piece should it ever be necessary.

FEATURE	JETSTREAM	MADAWASKA	DUMONT	COMMENT
INDUCTION AND PRIMARY AIR SYSTEM	SINGLE BLOWER, EXTERNAL TO MAIN UNIT	TWO BLOWERS (One at base and one in flue connector)	SINGLE BLOWER, COMPLETELY ENCLOSED IN BOILER HOUSING	The use of a single blower allows a close balance of induction and primary air. High static blower provides turbulence and chamber scavenging necessary to ensure complete combustion.
AUTOMATIC SHUTOFF OF PRIMARY AIR WHEN LOADING	YES, with complicated linkage	NO	YES	A simple spring actuated piston shuts off primary air.
END-OF-FIRE THERMOSTAT	NO (Must set timer by hand)	NO (Must set timer by Hand)	YES (Timer used only on cold start)	Eliminates wasted electricity and heat loss through cooling of non-firing boiler.
INSULATED JACKET	YES	PARTIAL	YES	An important safety and energy conservation feature - allows Dumont to be fired in summer for domestic hot water
NOW SOLD	ASSEMBLED AT FACTORY	ASSEMBLED ON SITE	ASSEMBLED AT FACTORY	

Robert Bell Industries Limited

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EFFECTIVE: June 1, 1983

TEMPEST® PRICING SCHEDULE

Canadian List Price Sheet

COMPONENT		LIST PRICE
TEMPEST® 130/W		$3,325.00
TEMPEST® 130/O*		$3,809.00*
TEMPEST® 350/W COSP# WWD131		$5,156.00
TEMPEST® 350/O COSP# WWD131		$5,729.00*
PK-130	Pre Piping Kit	$ 735.00*
PK-350	Pre Piping Kit	$ 954.00*

NOTES: Above boilers furnished with:

W - (Wood Only) blower controls and high limit aquastat.

O - (Wood/Oil) Beckett "AF" oil burner, service switch, blower controls, high limit aquastat and low limit aquastat.

1. All prices are in Canadian dollars.
2. Prices are F.O.B., Seaforth, Ontario
3. COSP# for above boilers is WWD131.
*4. Prices include 5% Federal Sales Tax.
5. All prices are subject to change without notice.

MANUFACTURED UNDER LICENSE FOR:

Dumont Industries
P.O. Box 148
Monmouth, ME
USA 04259
TELEPHONE: (207) 933-4811

P.O. Box 70
148 Main St. S.
Seaforth, Ont.
N0K 1W0
Tel: 519-527-0800
Telex: 069-55305

Robert Bell Industries Limited

EFFECTIVE: June 1, 1983

TEMPEST[R] PRICING SCHEDULE

Heat Storage Tanks

Model N_2 - INTEGRAL EXPANSION (Nitrogen)

PRICE SCHEDULE

ASSEMBLED & TESTED

Dia (in)	1000 gal	1500 gal	2000 gal	2500 gal	3000 gal	3500 gal
36"	$2,027.00	$2,616.00	$3,419.00			
48"	$1,982.00	$2,270.00	$2,693.00	$3,211.00	$3,588.00	
60"	$1,970.00	$2,278.00	$2,682.00	$2,858.00	$3,180.00	$3,485.00
72"	$2,167.00	$2,568.00	$2,690.00	$3,130.00	$3,571.00	$3,786.00

KIT (UNASSEMBLED)

Dia (in)	1000 gal	1500 gal	2000 gal	2500 gal	3000 gal	3500 gal
36"	$1,568.00	$1,949.00	$2,377.00			
48"	$1,482.00	$1,729.00	$2,026.00	$2,336.00	$2,587.00	
60"	$1,538.00	$1,736.00	$1,931.00	$2,107.00	$2,304.00	$2,526.00
72"	$1,792.00	$2,068.00	$2,189.00	$2,338.00	$2,737.00	$2,953.00

1. Kit Tanks are shipped unassembled and include two dished heads and appropriate midsections (180° or "half donuts") to permit passage through most doorways. All tappings and flanges are factory welded in place.

2. Consult the Heat Storage Tank brochure for tank dimensions and construction. Additional or modified tappings and coil flanges are available on application.

3. These tanks are suitable for up to 30 PSI working pressure in applications not requiring the use of ASME Code tanks. ASME Code tanks are available - prices and specifications on application.

4. All prices and specifications are subject to change without notice.

5. All tank sizes are in U.S. gallons.

6. Tank insulation kits available, P.O.A.

7. DHW Domestic hot water coils $300.00.

8. All prices are F.O.B. Seaforth, Ontario, Canada. Federal & Provincial Sales Taxes extra, where applicable.

P.O. Box 70
136 Main St. S.
Seaforth, Ont.
N0K 1W0
Tel: 519-527-0600
Telex: 069-55565

TEMPEST® WOOD HEATING SYSTEM

Tank Insulation Kits

LIST PRICE SCHEDULE

Dia. (in)	1000 gal	1500 gal	2000 gal	2500 gal	3000 gal	3500 gal
36"	$401.00	$547.00	$757.00			
48"	$316.00	$419.00	$537.00	$640.00	$758.00	
60"	$291.00	$379.00	$452.00	$540.00	$629.00	$703.00
72"	$297.00	$297.00	$418.00	$481.00	$560.00	$624.00

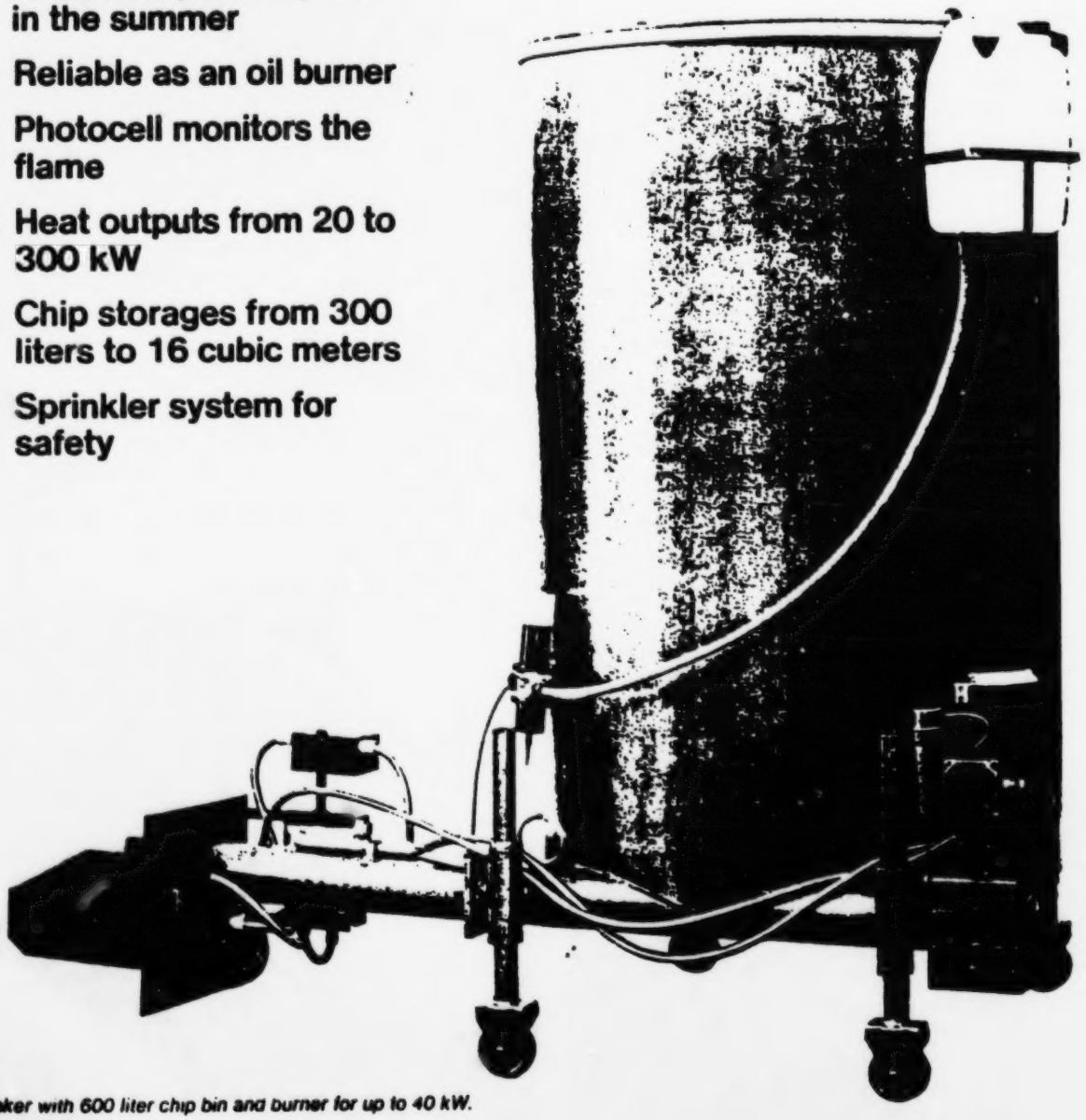
1. All prices and specifications are subject to change without notice.
2. All prices include 5% FST.
3. All prices F.O.B., Seaforth, Ontario.

EFFECTIVE AUGUST 1, 1983

THE VALLSTA STOKER

Electronically controlled chip burner with electrical ignition.
Ignites and shuts off automatically.

- Functions perfectly even in the summer
- Reliable as an oil burner
- Photocell monitors the flame
- Heat outputs from 20 to 300 kW
- Chip storages from 300 liters to 16 cubic meters
- Sprinkler system for safety



Stoker with 600 liter chip bin and burner for up to 40 kW.

VALLSTA MEKANISKA

The Vallsta Stoker

110

Chip heating with oil burning features

A fully automatic chip burner that ignites and shuts off the flame just like an oil burner. The burning is controlled by the furnace thermostat.
The unit is very reliable and needs almost no monitoring.

The Vallsta Stoker is a system of modules including chip burner, chip screws and chip storage for heat outputs from 20 to 300 kW.

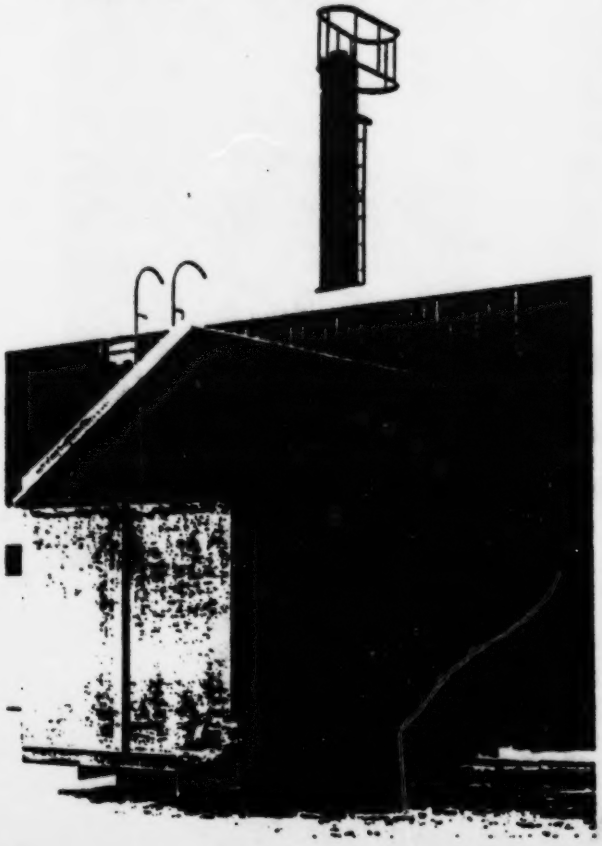
The Vallsta Stoker can be combined with most furnaces on the market.

The Vallsta Stoker is also available as a complete furnace room with chip storage and furnace in a container design – easy to move, easy to connect to a heating system.

Function

The Vallsta Stoker functions basically like an oil burner controlled by the furnace thermostat. When the thermostat is activated, a glow spiral is heated up, and chips are fed in for approx. 50 seconds. The air fan starts working and warm air passes over the glow spiral, thus igniting the chips. A photocell notices the flame and gives an impulse which starts the stoker screw again. The glow spiral is shut off, and the stoker is in operation.
When the furnace has reached its maximum temperature setting, the furnace thermostat is de-activated. The stoker screw stops while the fan works a few more minutes to make sure that all of the chips burn up. As a safety against so-called backfire, the stoker screw feeds in more chips for a few seconds.
The cycle starts again when the furnace thermostat is re-activated at its minimum temperature setting.
The photocell monitors the flame constantly and shuts off the stoker screw when too much fuel is fed in or if the chips are too wet to burn properly.

16 cu.m chip storage with variable-speed feeder screw.



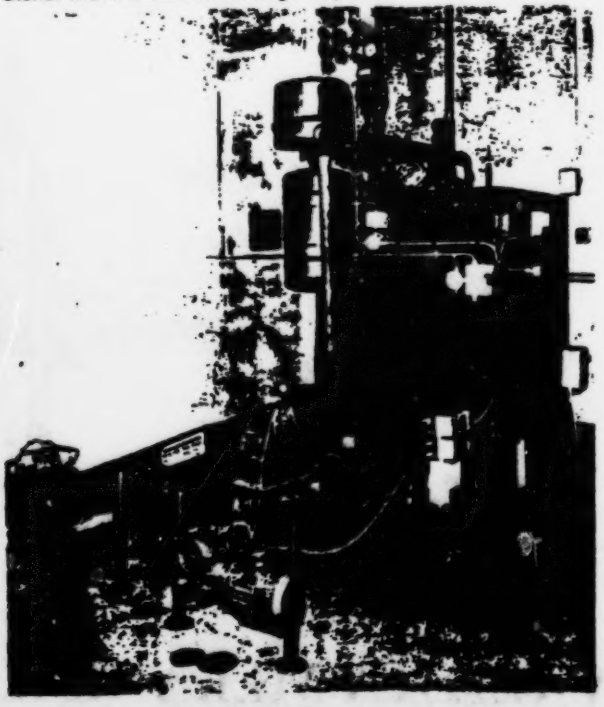
Choice of size

The size of the stoker unit depends on the size of the furnace, the heating need and local chip storage facilities.
For one-family houses and other projects where heating requirements are low, chip bin, stoker and chip burner are usually delivered in one unit. For larger heating needs and when it is possible to store larger quantities of chips, a larger chip bin of up to 16 cu.m combined with one or more screws and suitable transitions will be offered.

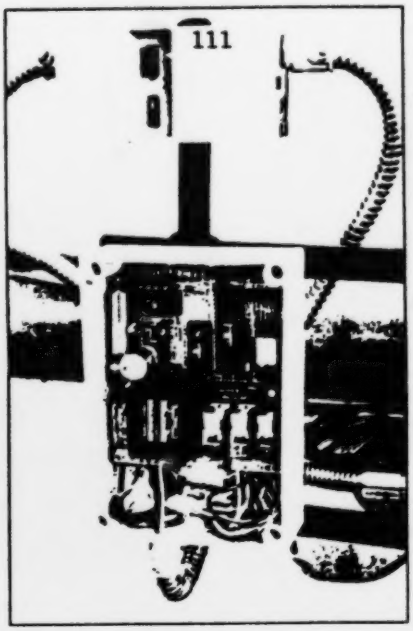
Installation

The stoker can be connected to most existing furnaces by removing a hatch and adjusting the stoker in height to fit the opening, if required. The stoker can also be installed on the side of the furnace.
Electrical connections should be made by a licensed electrician.

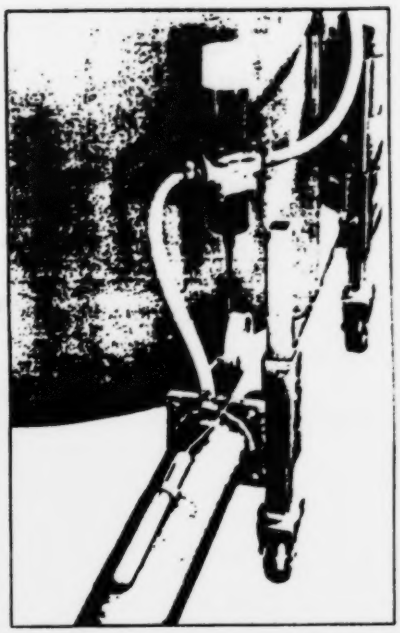
Stoker with transition from large chip bin.



Chip burner with cover towards the furnace opening.



Micro-processor which controls combustion.



Sprinkler system, sensor and thermal valve.

Design

The Vallsta Stoker is composed of chip bin, stoker, chip burner and equipment for control and monitoring of the combustion process.

Chip bin. The smallest stoker has a 300 or 600 liter chip bin as standard. Larger stokers have chip bins from 2 to 16 cu.m. But even the smallest stoker can be equipped with a larger chip bin.

Stoker screw. The chips are fed to the burning bowl by a screw conveyor which is driven by a gear reduction motor. The stoker screw drives an agitator in the chip bin so that all chips can be fed out. For longer transport distances, several screws are used. Each transition is equipped with level control and inspection hatch.

Chip burner. The burner consists of a chip bowl with ignition spiral and air fan. The ignition spiral ignites the chips at the start of each cycle.

Electronics. A micro-processor is the brain of the electrical system. It controls ignition and shut-off as well as the stoker screw and monitors the combustion process by means of a photocell. The micro-processor gives extreme safety when heating with chips.

Sprinklers. A sensor on the stoker screw feels the temperature in the stoker and activates a valve, thus letting water into the stoker if "backfire" occurs.

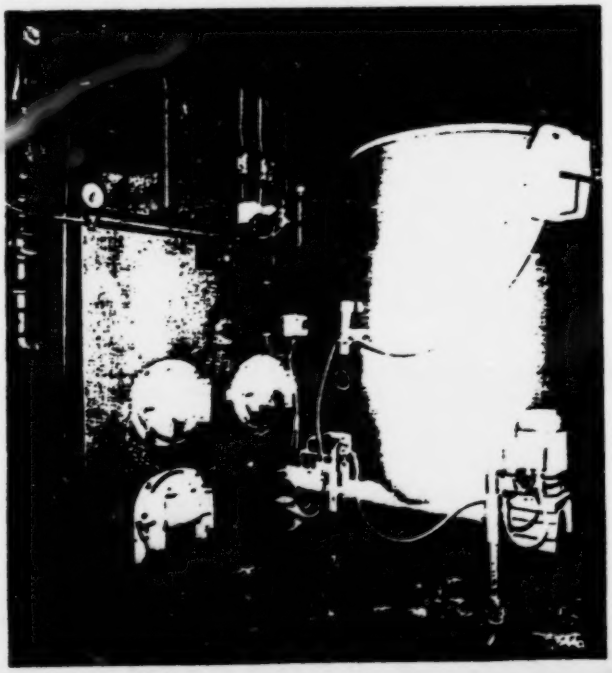
Accessories

Burner for pellets.

Automatic ash removal (for larger units only).

Variable drive for the stoker screw to adapt feeding speeds to different chip qualities.

Stoker installed in front of the furnace.



Heating plants

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For larger heating requirements, we can offer complete plants with chip storage, furnace room, furnace and chimney, built as a unit in a container.
This unit can be put anywhere and be connected to the heating system through a culvert, which is often more favourable than combining the chip bin, feeding screws and burner with an old furnace.

Drying

The automatic system of the Vallsta Stoker makes it ideal as a source of energy for hot-air processes, kiln driers, grain driers and the like.

Complete heating unit delivered to an estate and connected to the heating system through a culvert.

Technical data

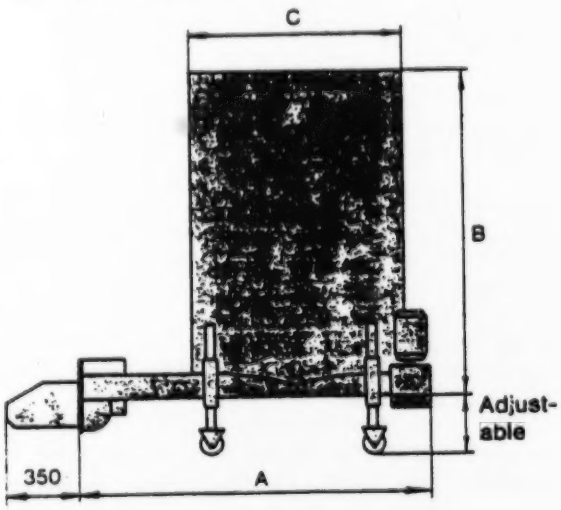
Chip storage with agitator, feeder screw and gear reduction motor. The bin has a hinged lid and a manual opening device.

Chip Volume m³	Length m	Width m	Height m
2	2	1	1
4	2	1	2
8	2	2	2
9	3	1.5	2
16	4	2	2

Bottoms for chip storages with agitator and feeder screws can be delivered for installation in existing systems.

Chip burner with electrical ignition, stoker screw and gear reduction motor. Chip burners for 20 % moisture content in the fuel are available for 40, 50, 80, 150 and 300 kW. Maximum moisture content is 40 %.

Dimensions of a complete stoker unit.



Measurement Data

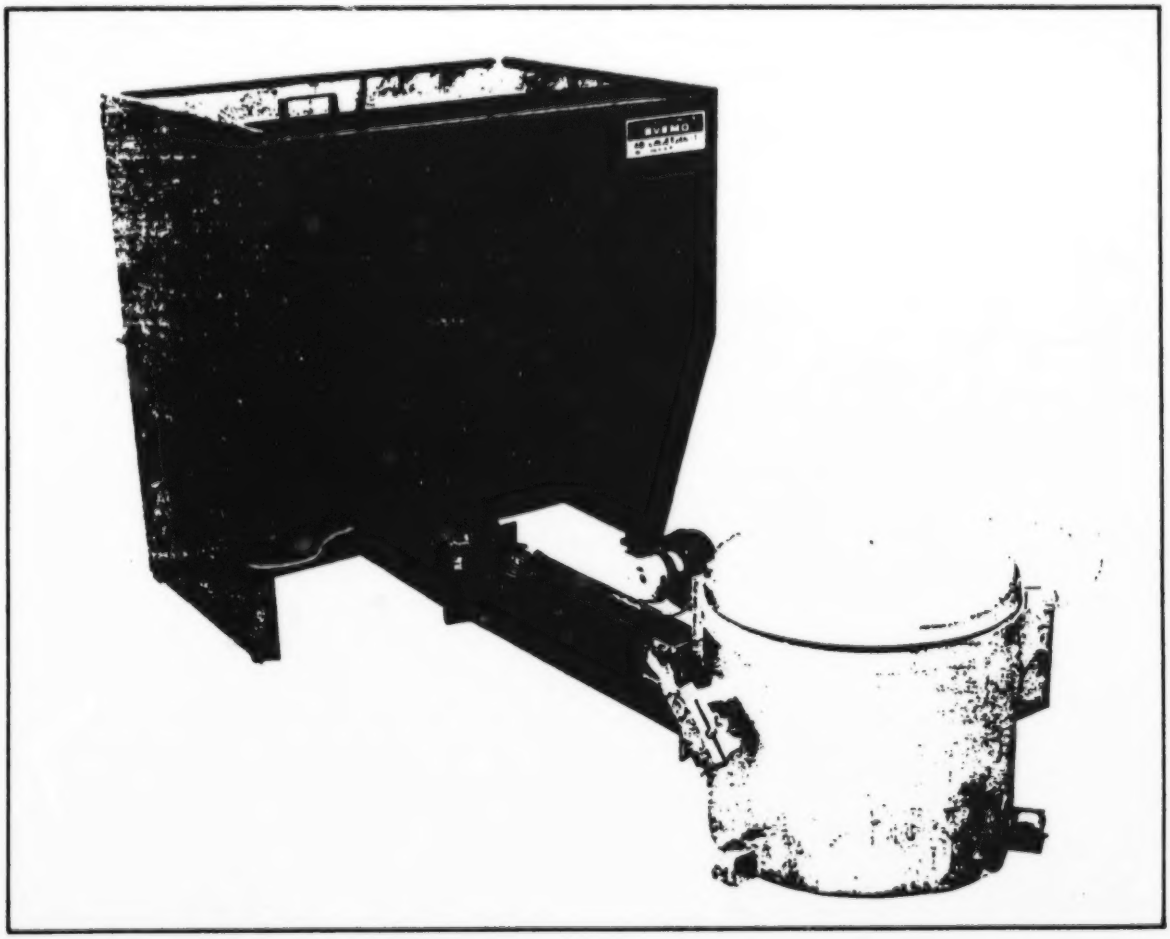
Chip Volume in Liters	A mm	B mm	C=Width mm
300	950–1200	1000	640
600	1150–1400	1200	790

We reserve the right to alter data and dimensions.

AB VALLSTA MEKANISKA
PI 536 S-820 11 VALLSTA
Tel +46 278-456 58
Sweden

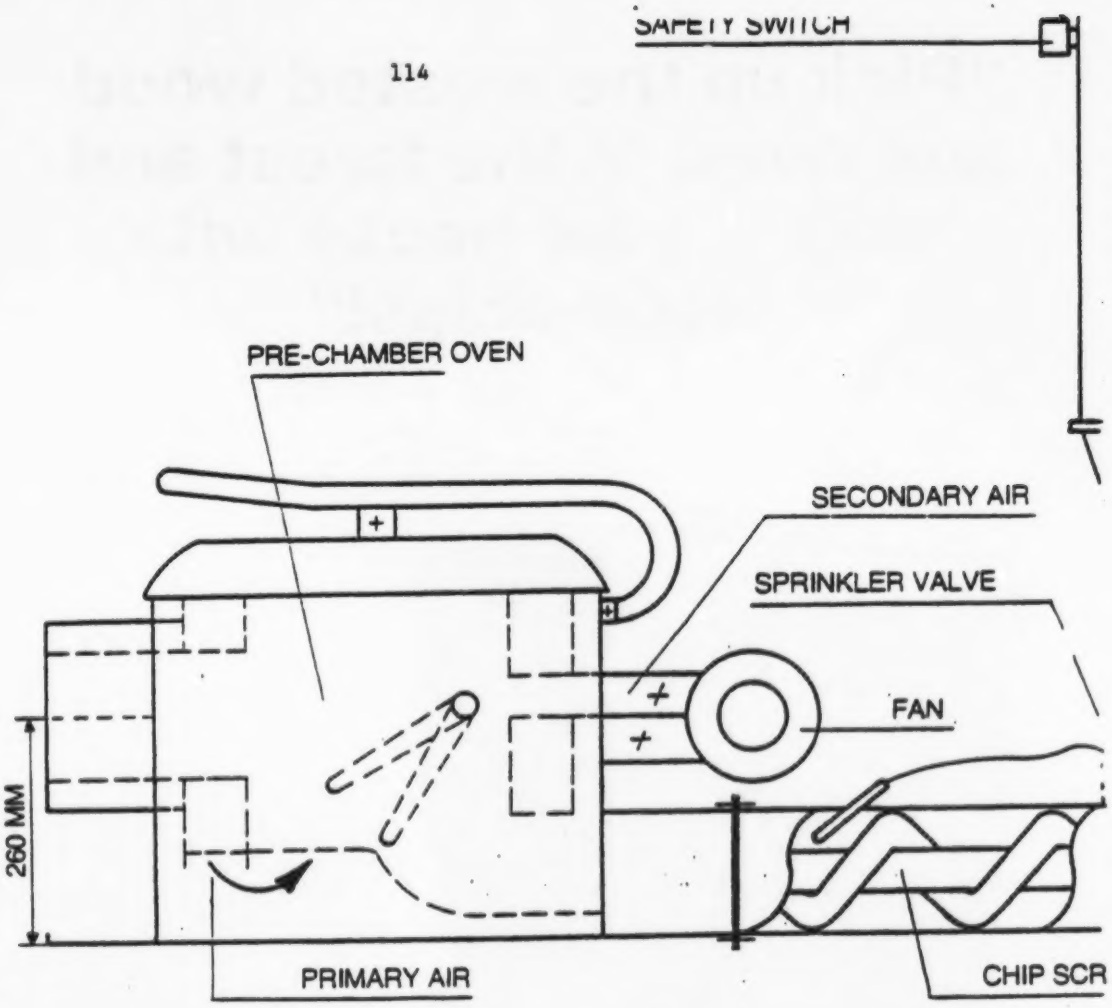
BDR MACHINERY LTD.
1104 FEWSTER DRIVE • MISSISSAUGA, ONT.
L4W 2V7 (416) 625-6236 TLX • 06-9804

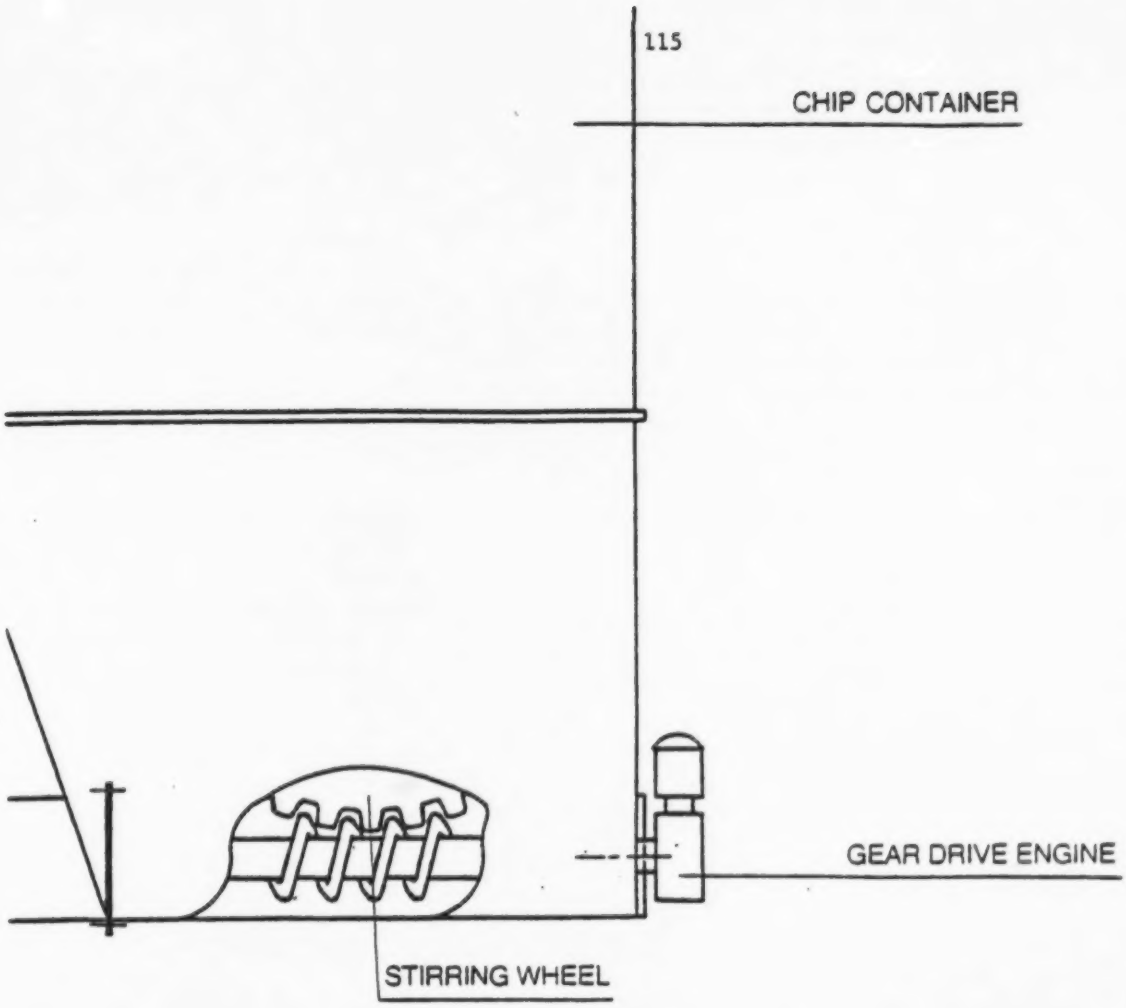
"Pick up the wasted wood and twigs in the forest and heat your house with wood-chips!"



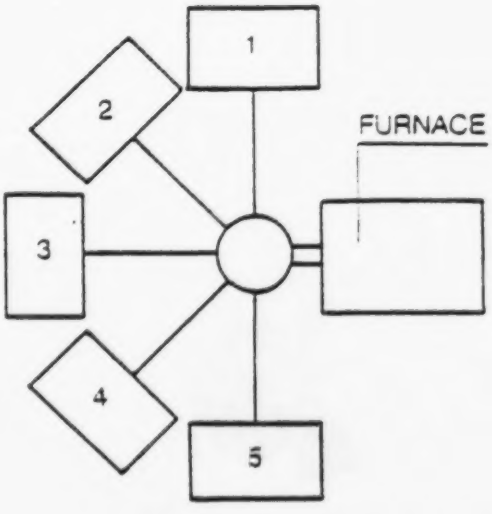
Chipburning unit SVEMO

Pre-chamber oven type Cello To be used with a centralheating furnace producing 272 MJ (65 000 Kcal) and 554 MJ (130 000 Kcal) respectively Chip container for 800—1300 liter (200—340 US gallon) Can be connected to a larger silo Burns all kind of saw-dust and wood-chips — from green whole-tree chips to dry hard-chips Patented


SAFETY SWITCH
PRE-CHAMBER OVEN
SECONDARY AIR
SPRINKLER VALVE
FAN
260 MM
PRIMARY AIR
CHIP SCR



A lot of alternatives for placing of the pre-chamber oven. The oven can easily be connected to the furnace.



Description

SVEMO chipburning unit consists of a chip container and a prechamber oven. In the container there is a stirring wheel, which is connected to a screw, which feeds the oven with chips.

Function

The unit is so constructed that it will give a heating without any disturbances. The stirring wheel manages all kind of chips, both whole-tree chips and hard chips. The level-teller in the oven tells automatically when it is time for the screw to feed more chips to the oven. With the high temperature in the oven, you can even burn raw chips.

Specifications
Complete unit:

Length	2000 mm
Width	1050 mm
Height	1000 mm

Chip container 800—1300 liter
(200—340 US gallon).
Special units are manufactured.

Chip economy

Thanks to the wasted wood and the twigs in the forest, you can heat your house, garage or factory very economically in spite of the increasing oilprices.
Convince yourself with the following calculation:

1 m^3 of piled wood gives about 1,7 m^3 of chips. 12 m^3 of chips give the same heating effect as 1 m^3 heating oil.

Oil

I use _____ m^3 heating oil.
I pay _____ /m^3 heating oil.

Chip

To get the same heating effect as for oil, I need _____ m^3 of chips. (12x the amount of oil).
To get the same heating costs as for oil, I can pay _____/m^3 for the chips.

$$\left(\frac{\text{oilexpenses}}{\text{needed amount of chip}}\right)$$

Re-sale

Manufactured by

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